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LOCALLY BUILT FISH SCREEN PROGRAM III

FUNDED BY
US FISH AND WILDLIFE SERVICE

#14-48-1133-98-J051
98-FP-04

FINAL REPORT

ABSTRACT

Using funds from the US Fish and Wildlife Service, the Siskiyou Resource Conservation District (District) directed the construction and installation of a self-cleaning fish screen for the Bemrod (MacGowan) Ditch off French Creek. This ditch diverts approximately 2.36 cfs of water in prime salmonid rearing and spawning habitat. This fish screen was the third screen that the District was able to complete following the 1997 NMFS and CDFG screening criteria.

A fish screen is a physical barrier preventing fish from moving down an irrigation diversion. A self-cleaning fish screen has brushes that move across the screen face to remove suspended debris. This design was reviewed and approved by the California Department of Fish and Game, the National Marine Fisheries Service, and the Natural Resource Conservation Service.

The District is pleased with the Locally Built Fish Screen project. This project provided fisheries protection, employed local contractors including displaced timber workers, and assisted a water user with preventing "take" of a federally listed species.

SPONSORED BY

SISKIYOU RESOURCE CONSERVATION DISTRICT
PO BOX 268
ETNA, CALIFORNIA 96027
(530) 467-5216
4/15/2000

2002-011104/NF BEST COPY AVAILABLE COMPLETED

INTRODUCTION

The objective of this project was to reduce mortality of juvenile salmonids by installing a self-cleaning fish screen on the Bemrod (MacGowan) ditch, off French Creek. While this project specifically funded the installation and construction of one screen, the District has a more general Fish Screening Program. The objectives of the Fish Screening Program are to: protect fisheries from direct fish loss; provide employment for the local community; and, assist water users with preventing "take" as defined by the Endangered Species Act.

The Siskiyou Resource Conservation District (District) is a special district of the state of California directed by a board of property owners who have chosen to be proactive in addressing water quality and fishery issues within the Scott River watershed. The Scott River is fed by high mountain runoff. These mountains (exceeding 8,000 feet) encompass Scott Valley, a fertile valley dominated by agricultural use. The floor of Scott Valley and low tributary areas are partially irrigated via diversion ditches. One concern with diversion ditches is the capability to divert fish as well as water. The decline in fisheries has highlighted the concern related to fish loss through flood irrigation.

Juvenile salmon, steelhead, and native trout hatch then migrate out of the upper portion of the watershed during the following spring and summer. During their down migration to the ocean or larger bodies of water, a juvenile can migrate down a diversion ditch where they are lost during irrigation. In 1995, the District worked with the local watershed group, the Scott River Watershed CRMP Council (Council), to develop a Fish Screening Program. Since then, the District in cooperation with the Council has directed the construction and installation of 9 locally built fish screens. Fish screens prevent fish from entering diversion ditches and being left stranded on fields that are flood irrigated.

The distinction of the Scott River Fish Screening program is that the fish screens are maintained and operated by the water users, and built by local people. Historically, the California Department of Fish and Game (CDFG) has worked with water users to install and maintain fish screens. The water user would pay for half of the construction and installation costs. The CDFG would pay the rest of the bill and maintain the screen semi-weekly. Private ownership of fish screens is an advantageous alternative since it directly involves the water user in voluntary fisheries conservation and saves the CDFG from spending money on maintenance that can be used for construction of other screens. The water user requests the screen installation and maintains it for at least ten years. In addition, the construction and installation occurs during the non-irrigation season (winter), which is when the need for employment is high.

DESCRIPTION OF STUDY AREA

The Scott River Basin is located in south-central Siskiyou County, California, approximately 30 miles south of the Oregon border. There are three separate adjudication documents that fully adjudicate the surface flows and a portion of groundwater in the Scott River Basin. There are 726 diversions covered in the Scott River adjudication, 29 covered in the Shackleford Creek adjudication, and 54 covered in the French Creek adjudication. In 1995, an informal inventory conducted by the Distrcit listed 141 active diversions potentially accessible to fish including 5 river pumps.

The inventory showed thirty diversions had operating fish screens: twenty-eight were CDFG projects; two were District projects. Since then, the District has installed an additional 9 screens. The District has 9 screens scheduled for completion by 2002 and several more screens are proposed for future funding. If all currently funded screens are installed, there will be approximately 93 remaining diversions that need screens.

The Bemrod (MacGowan) ditch was selected as a priority screening site because it is within prime salmonid spawning and rearing habitat. The adjudicated water right is 2.36 cfs. Fish counts performed by the CDFG within French Creek are on file at the Yreka Habitat Improvement Office.

METHODS AND MATERIALS

Methods

This fish screen was the third screen that the District was able to complete following the 1997 NMFS and CDFG screening criteria. This newer criteria was a result of the federal listing of the coho salmon as threatened in 1997. The listing gave the National Marine Fisheries Service (NMFS) jurisdiction over inland fisheries since the coho salmon use both the ocean and inland streams for habitat. Prior to 1997, the local CDFG screen shop would assist the District by reviewing the proposed site and design of fish screens. The CDFG had specific fish screening criteria that had to be met. However, in 1997 the NMFS issued a different set of fish screening criteria. In order to ensure proper design and review, the District invited representatives from the NMFS, the NRCS, and the CDFG to meet and direct our fish screening efforts. The result was a process where both the local CDFG screen shop and the NMFS would review proposed sites and designs of fish screens. The NRCS would also be part of the review process when they helped fund a project.

The following list represents the process that the District followed for fish screening the Bemrod ditch:

- Obtain landowner interest
- Collect information about site: visit site with water user; determine estimated flow by reviewing adjudication records and talking with water user; determine priority of site based on biologic need and amount of flow
- Prepare proposal for funding
- IF FUNDED, visit site with CDFG for site placement and permit review (request permit if necessary)
- Visit site with CDFG for biologic report
- Survey site for ditch slope, channel slope, bypass slope, ditch cross sections and elevation control
- Measure largest ditch flow for maximum design flow (don't rely on adjudication records, design is for fish protection not flow enforcement)

- Prepare preliminary design including narrative, hydraulic calculations, concrete and fabrication specifications, and cost estimate
- IF THERE IS NRCS funding, review design with NRCS and make necessary changes
- Review design with local CDFG screen shop, water user, and NMFS; make necessary changes
- Prepare contract for construction and installation
- EITHER OPEN BID (>$10,000) or SELECT CONTRACTOR (<$10,000)
- Coordinate each phase of project: site prep; concrete work; fabrication; installation; and maintenance training
- Open ditch, test operation, and make adjustments
- Visit site with all interested parties (specifically CDFG and NMFS) for final review and approval

The District was able to perform all the preparation and design work. The construction and installation were contracted services. A series of drawings were prepared using a computer-drafting program (CAD). The CAD drawings allow for relatively quick modifications and provide clear instructions to contractors. A copy of the design docket with CAD drawings is included in Appendix A. Figure 1 is an isometric view of the fish screen structure as drawn using AutoCAD.

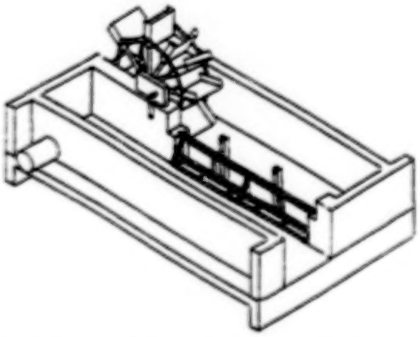

Figure 1. Isometric View of Self-Cleaning Fish Screen without Brush Assembly or Screen Panels Installed

In order to better understand all aspects of fish screening construction and installation, the District chose to subcontract separate phases of the construction and installation. In other fish screen projects, the construction and installation were completely subcontracted to one local contractor. With this project, however, there was a separate contractor for concrete work and fabrication who worked directly with the District's project coordinator. The District plans to continue to use this approach.

Materials

A self-cleaning, vertical plate fish screen was determined to be the best design. The design is a permanent concrete structure with a perforated screen that prevents fish passage downstream the ditch. The fish enter the structure and are routed to a bypass pipe that carries them back to the stream. The irrigation water is allowed to pass through the screen and down the ditch. There is a paddle wheel at the exit of the structure that turns when the water moves through it. The paddle wheel drives a brush assembly that moves back and forth across the perforated screen removing suspended debris. Figure 2 is a photo of the completed screen during operation.

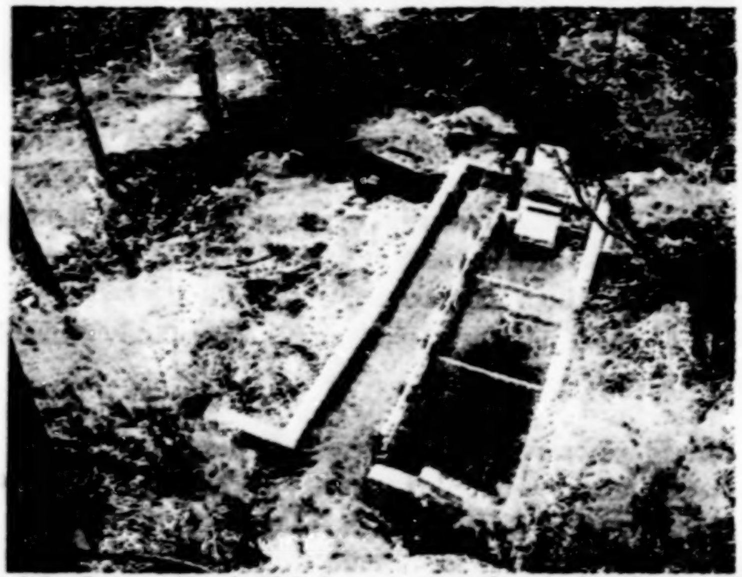

Figure 2. MacGowan/Davis Fish Screen operating during Spring 2000.

The materials used for this fish screen have been carefully selected based on past experience and cost effectiveness. The screen material is perforated-plate, stainless steel. All metal parts of the screen are painted to prevent rust and extend the life of the material. Stainless steel is used for the screen material because it does not rust. The current fish screening criteria requires holes no larger than 3/32". Painting the screen material would reduce the hole size and increase the head loss through the screen thereby reducing the amount of water that passes through the screen.

The paddle wheel is made of aluminum. Aluminum was selected to reduce the weight of the paddle wheel and minimize the force necessary to operate it. While a greater mass provides greater inertia and momentum while moving, it also requires a greater force to begin movement. During low flow conditions, there is little force to move the paddle wheel.

The rest of the screen structure is made of mild steel. All bearings have grease zerks. There is easy access to replaceable parts by using: a removable top and side panel for the gear box; a removable strap for the brushes; and, nut and bolt attachment of wheels, bearings, and neoprene strips.

The bypass pipe is made of 12" black, plastic pipe. The outside is corrugated for rigidity and strength. The inside is smooth to minimize turbulence and reduce risk of sharp edges that can harm fish. The pipe was installed in sections with a connection near the high water mark. After irrigation, the water user can remove the section of pipe closest to the stream to prevent losing the pipe during high water.

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RESULTS AND DISCUSSION OF ACCOMPLISHMENTS DURING THE PROJECT

The primary objective of this project was met. The District installed a self-cleaning fish screen, to be totally maintained by the water user for the life of the structure. There is a bypass to return fish to the stream. There is a flow control (head gate) upstream of the fish screen structure. Excess water is controlled at the head gate.

In addition, two other objectives have been met: the employment of targeted groups, and the prevention of "take". A local fabricator, a local concrete contractor, and several local laborers were employed. The fabricator and laborers are displaced timber workers. Prevention of "take" is a paramount concern for water users in Scott Valley. The fish screen provides a physical barrier preventing fish from moving down the diversion. This structure is an important component in the water users conservation plan.

There are a number of benefits of this project. Three of them have already been listed as objectives. However, one of the most long-term and practical results of this project is the establishment of a review process for fish screens designed by the District. There now exists a relationship between all involved agencies including the NMFS, the CDFG, and the NRCS. Without a process, the Fish Screening Program could not have moved forward. There is tremendous support from the local community for fish screening.

SUMMARY AND CONCLUSIONS

The District is pleased with the success of the Locally Built Fish Screen project. The District screened a 2.46 cfs diversion ditch off French Creek. The water user is willing to clean and maintain the screen structure. This provides more funding for screen construction and installation. The expectation of the District to design fish screens using District staff was met. A review process was established with the necessary agencies. The cost for design has been reduced as realized in other projects. A separate contractor for each phase has shown success. Several people were employed during depressed winter months. Most importantly, there are a number of landowners interested in having the District coordinate other fish screen installations.

SUMMARY OF EXPENDITURES

LOCALLY BUILT FISH SCREEN PROGRAM III

#14-48-1133-98-J051

98-FP-04

Budget Item	USFWS Original [2]	**USFWS Adjusted**	USFWS match [3]	FSA	In-Kind [4]
Salaries [1]	1,325.00	**4,224.90**	544.00		2,200.00
Travel and transportation	88.00	**129.33**	70.00		1,200.00
Expendable equipment, materials, supplies	260.00	**282.38**	107.53		210.00
Construction	7,516.00	**4,552.39**	63.83	3,500.00	
General Administrative Expenses	918.00	**918.00**	78.54		200.00
SUBTOTALS	10,107.00	**10,107.00**	863.90	3,500.00	3,800.00

GRAND TOTAL	**18,270.90**

[1] The difference between original salaries and adjusted salaries was due to the RCD staff designing the fish screen instead of the NRCS. As a result, the In-Kind contribution for salaries was less than expected.

[2] USFWS original budget amounts were adjusted as shown in the USFWS Adjusted column.

[3] USFWS match was provided by Scott River Riparian Woodland Reveg (French Creek Reach), ID #96-JITW-05, Agreement #14-48-0001-96672. The match was provided by an unused balance of funds.

[4] In-Kind contribution includes:
NRCS development of initial AutoCAD drawings; NRCS survey assistance; NRCS, CDFG, and NMFS site visits, design review, and technical assistance; and, use of NRCS copier and computer.

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MACGOWAN/DAVIS FISH SCREEN STRUCTURE

DESIGN DOCKET AS REQUIRED BY NRCS

APPENDIX A – DESIGN DOCKET

A

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UNITED STATES
DEPARTMENT OF
AGRICULTURE

MACGOWAN/DAVIS RANCH

ACP SPECIAL PROJECT

STRUCTURE FOR WATER CONTROL

FISH SCREEN AND BYPASS   587-C

In cooperation with the
Siskiyou Resource Conservation District

March 1999

CALIFORNIA
NATURAL RESOURCES
CONSERVATION SERVICE

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UNITED STATES DEPARTMENT OF AGRICULTURE

NATURAL RESOURCES CONSERVATION SERVICE

Yreka, California

Name: MacGowan/Davis Ranch
Project: Water Control Structure/Fish Screen
Job Code: 587-C
Engineering Class: V
Field Office Engineering Job Number: Y-98-3
FSA Control Number: 96-0021

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UNITED STATES DEPARTMENT OF AGRICULTURE

NATURAL RESOURCES CONSERVATION SERVICE

Yreka, California

March 1999

DESIGN REPORT

JOB: Structure for Water Control/Fish Screen

LANDOWNERS: Nancy MacGowan, Bess Davis
6915 Miners Creek Road
Etna, CA 96027

JOB LOCATION: Take French Creek Road, 2 miles west from the Hwy 3 turn-off, 7 miles north of Callahan, CA. The screen is located in Section 32, T.41 N., R.9 W., MDM; at the entrance to the JH Ranch, on the upstream side the bridge.

COUNTY: Siskiyou

RESOURCE CONSERVATION DISTRICT: Siskiyou

I. SUMMARY

The proposed project is a fish screen and bypass to protect anadromous fish in French Creek. This work will benefit 55 acres of irrigated pasture that is classified as Land Capability Class (LCC) IV and VI.

II. ORIGIN OF REQUEST

Nancy MacGowan applied through the 1996 Agricultural Conservation Program for Special Project Pooling Agreement funding at the Siskiyou County FSA office. There is another minor water user on this ditch who may participate in the project.

III. DESCRIPTION OF PROBLEM

The landuser is concerned about protecting and improving the anadromous fishery in the Scott River. This is an existing gravity diversion into the "Bailey" or "Bemrod" ditch, showing a water right of 2.36 cubic feet per second (cfs) in the French Creek Adjudication.

C. Water Quality

1. The existing high quality flows will not be negatively affected by the self-cleaning fish screen or bypass, except during construction.

VI. DESIGN CRITERIA

The specifications for this fish screen and bypass are required by the California Department of Fish and Game and the National Marine Fishery Service (NMFS). Refer to the attached performance requirements for the design criteria.

VII. CONSTRUCTION

The project will be coordinated with the Siskiyou Resource Conservation District. Construction supervision will be by the RCD Project Coordinator.

The project will be built using forces and equipment of the landowners. CAL-OSHA safety requirements to be in effect during all construction. The landowners shall be responsible for obtaining any needed permits, easements, and/or right-of-ways, and meeting any legal requirements.

VIII. MAINTENANCE

Proposed improvements will require proper maintenance for satisfactory operation as planned. The landowner will be responsible for annual inspection of the project or more often if necessary for 10 years. The fish screen needs to be removed each fall after irrigation season to protect it from flood conditions and freezing.

All annual maintenance of the fish screen is the owner's responsibility for ten years. This will include greasing of moving parts, painting metal, inspection of screens, brushes and cleaning out of trash rack and bypass debris.

IX. ENGINEERING JOB CLASSIFICATION

The controlling classification factor for Structure for Water Control, Fish Screen (587-C) is the assistance to units of government at the statewide level. NRCS National Engineering Manual, CA part 501 states that approval of the State Conservation Engineer is required, if the specifications require interagency agreement. This design requires the concurrence of the National Marine Fisheries Service and the California Department of Fish and Game.

PREPARED BY: ______________________ DATE: 3-17-98
Conservation Technician

DESIGNED BY: Lorrie Gundy DATE: 3/17/98
Siskiyou RCD Engineer-in-Training

CONCURRED BY: Rich Roberts DATE: 3/20/98
Field Office Engineer

REVIEWED BY: ______________________ DATE: 3/26/98
Area Office Engineer

APPROVED BY: Charles S. Davis DATE: 8-13-99
State Conservation Engineer

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Siskiyou RCD
PO Box 268
Etna, CA 96027

August 11, 1999

Marianne Hallet, Civil Engineer
Natural Resources Conservation Service
430 G. St., Ste. 4164
Davis, CA 95616-4164

Dear Marianne:

This letter summarizes the most recent changes of the MacGowan/Davis Fish Screen design docket. All changes to the docket are a result of moving the proposed location downstream, new bypass pipe material, and the inclusion of supporting documentation. These changes are reflected in the design docket as summarized below.

Narrative, pg.2
A note was made to section V. Planning Considerations, 3. Soils, which reads "Bedrock outcrop is present. Construction details address this."

NMFS Correspondence, pgs. 5-7
This new section contains the letters from Rick Wantuck, NMFS, indicating acceptance of the design package as amended by the 5/24/99 letter from the Siskiyou RCD to NMFS.

Calculation Sheets, New sheets are indicated by the suffix "a" or "b"

- Sheet 2a shows the change in location.
- Sheets 4a and 5a contain the calculations for flow required in the fish bypass at the new location. Changes in the bypass calculation were necessary due to the change in slope (0.20 old, 0.18 new) and the change in material used for the bypass pipe (CSP n = 0.02 old, CPP n=0.01 new).
- Sheet 7a is a new sheet from a previous revision. It contains the calculations for the flashboard slots at the end of the structure.
- Sheet 11a contains the calculations for the orifice size necessary for the bypass to carry 1cfs at design flow. The new calculations were necessary due to the increased flow necessary to maintain adequate depth in the smoother pipe.
- Sheet 13b contains the recalculated hydraulic grade line.

Survey Sheets, pgs. 35-37
The reduced survey notes for the original location and the new location are included here.

Plan Drawings

- Sheet 1a shows the change in location and fish bypass alignment. Two bypass alignment alternatives were considered. A bedrock outcrop is present between the ditch and the creek. This prevents the preferred alignment of the bypass pipe which is straight off the side wall toward the creek since either a drop structure or bedrock

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removal would be necessary. Another alignment was selected as shown in the drawing.

Sheet 2a shows the new ground and bypass elevation profile.

Sheets 3b and 4b show the changes to the box structure necessary to accommodate the bypass pipe. The alignment of the bypass pipe to the box required a significant bend in the bypass pipe if the pipe were attached to the side wall as in the previous design. The bend can be prevented if the pipe is attached to the exit wall as shown.

Sheet 10a now contains the specification of aluminum for the paddle wheel.

I hope this letter clarifies what items have been changed and why. Please contact me at (530) 467-5216 if you have any questions. I look forward to hearing from you soon.

Sincerely,

Lorrie Bundy
Project Coordinator

National Marine Fisheries Service
Southwest Region
777 Sonoma Avenue, Suite 325
Santa Rosa, CA 95404

7/14/99

Ms. Marianne Hallet
Civil Engineer
Natural Resources Conservation Service
430 G Street, Suite 4164
Davis, CA 95616-4164

Dear Marianne:

I reviewed the design package (4/29/99) for the MacGowan fish screen project on French Creek in Siskiyou County, CA. The National Marine Fisheries Service accepts the design package, as amended by the Siskiyou Resource Conservation District on 5/24/99, as meeting the National Marine Fisheries Service criteria for fish screens in California.

The following comments are offered:

1. I conducted a field visit with Lorrie Bundy (Siskiyou RCD Engineer) and Ron Dotson (CDFG Fisheries Habitat Supervisor) on May 21,1999. We inspected the proposed site and decided that *the screen would be much better protected from flood damage if it were located on the other side of the road crossing, within 100 feet of the original design placement.* This will result in a longer bypass pipe, but I judged it worth the extra effort to plan on moving the screen to the new location. Lorrie Bundy analyzed the implications of a new location, and her findings are contained in a letter to me dated May 24,1999. That letter is enclosed with this correspondence for your review.
2. I am concerned that the channel width between the terminal end of the fish screen and the opposite exterior wall might be too narrow to facilitate easy cleanout of debris and sediment. Please investigate this detail and increase the width at your discretion.
3. Choose the deepest free flowing pool to serve as the outlet of the fish screen bypass.
4. Anchor the bypass pipe securely with hardware that will allow easy disconnect, should maintenance or repair be necessary.
5. Consider modifying the outlet of the bypass pipe with a low profile, v-notch weir if flow depth cannot be sustained within the bypass pipe.

Sincerely,

Richard L.Wantuck
Hydraulic Engineer

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5/24/99

Dear Rick:

This letter is a summary of recommendations and comments received during your field visit to the MacGowan/Davis fish screen site on May 21, 1999. All proposed design elements will remain as presented in the design docket except for those outlined below.

1. **The specific site location for the structure will be moved downstream of the proposed location.** The new site is downstream of the existing bridge that spans French Creek. The new site will provide flood protection not available upstream of the bridge. In addition, the proposed upstream control will not be necessary. The existing headgate can be used to return high flows to French Creek.
2. An initial site visit determined that downstream of the bridge was not a feasible site because of extensive bedrock outcroppings. The bedrock may limit the depth of excavation for cutoff wall and may prevent the burial of the bypass pipe. These issues are addressed below.
    - **The cutoff walls will built as planned (1.5' deep) or to bedrock.** The concrete forms will contour the shape of bedrock if encountered.
    - **Sections of the bypass will be buried or secured to the bank using cable where burial is limited by bedrock.** The bypass will be secured by cable in the following manner. Surrounding bedrock following the alignment of the bypass will be drilled 2" deep using a rock drill. A 3" eye-hook will be inserted into hole with epoxy glue. Cable, 1/8", will be threaded through paired eye-hooks, wrapped around the bypass pipe, and clamped tight to secure the bypass and prevent vertical and horizontal movement.
3. The slope of the bypass will remain the same as proposed, however, **the length of the pipe will be increased to approximately 60 feet.** A portion of the bypass pipe may be in high water during non-irrigation season, therefore the bypass pipe will be in two sections. The first section will be buried approximately 30 feet from the screen structure toward French Creek. The second section will be attached to the first with a collar and buried or secured as described in Item 2 above. The slope of the bypass pipe will be constant with no dips or drops .
4. **The bypass pipe will be changed from corrugated metal pipe to corrugated plastic pipe with smooth interior.** Using an "n" value of 0.01, 3/4 to 1 cfs is necessary to maintain a water elevation of 1.8" - 2" in the bypass pipe. One cfs is 1/4 of diverter's water use. While this diversion typically runs water all year, during low flows, it may be difficult to deliver that much water to the bypass. Ron Dotson of CDFG, Yreka Screen Shop, has stated that less water is adequate to safely deliver fish to the stream.

I hope I have clearly stated all items that Ron Dotson, you and I discussed during the field visit. Please call me if you need clarification.

Thanks for all of your help.

Sincerely,

Lorrie Bundy
Project Coordinator

National Marine Fisheries Service
Habitat Conservation Division
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404

July 14, 1999 F/SWR4: RLW

Ms. Lorrie Bundy
District Engineer
Siskiyou County Resource Conservation District
Etna, California

Dear Lorrie:

I reviewed the design for the MacGowan fish screen on French Creek in Siskiyou County, submitted by Natural Resources Conservation Service (NRCS 4/29/99). After a field visit on May 21, 1999, both Ron Dotson (Fish Habitat Supervisor, California Department of Fish &Game) and I felt that the screen would be better placed on the other side of the road crossing in order to protect the structure from a major flood event. Your correspondence to me on May 24, 1999 reflects that decision, and describes the design changes necessary to make the new location work. In light of these developments, I find the amendments to the original plan satisfactory, and I will so note these findings in a letter of acceptance for the design package to NRCS.

As a final suggestion, I recommend you consider a type of hardware (shackle or turnbuckle) for the bypass pipe that will allow easy attachment and disassembly for of the bypass pipe. This will facilitate easier maintenance or repairs. Please call me at (707) 575-6063 if I can be of further assistance.

Sincerely,

Richard L. Wantuck
Hydraulic Engineer

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BIOLOGICAL EVALUATION OF THE FISHERIES
FOR
BEMROD DITCH SCREENING PROJECT
ON
FRENCH CREEK

I. Proposed Action

(refer to Design Report for complete project description)

II. Existing Environment

Fish species of concern affected by the French Creek "Bemrod" or "Bailey" Ditch are steelhead (Oncorhynchus mykiss) and coho salmon (O. kisutch). For a more complete life history on steelhead and coho, please refer to the **Klamath River Basin Fisheries Resource Plan, U.S. Dept. of Interior, February, 1985**, prepared by CH2M HILL.

For current conditions of the aquatic environment in the upper Scott River basin (which includes French Creek), please refer to the **Callahan Watershed Analysis, U.S. Forest Service, March, 1997.**

Steelhead

Adult steelhead trout can be found entering the Scott River system throughout the year during spawning migrations. Because of overlapping runs (fall, winter, and spring), discussion of steelhead stocks is complex. Life histories of these stocks vary, with the principal difference being the time of year adults enter the system during their spawning runs.

In the Klamath Basin, steelhead typically spawn between January and late April. Fry emergence from redds generally begins in March. Juvenile steelhead can remain in the freshwater system for up to four years before migrating to the ocean. Migration of steelhead smolts usually occurs between March through July.

Coho

The Scott River and its tributaries support naturally spawning coho populations. Coho enter the system between October and January and proceed to their spawning grounds in the upper Scott River watershed and its tributaries. Upon completion of spawning, the adults die soon afterwards.

Coho fry emerge from the gravel between February and May. Juveniles will typically remain in fresh water to rear for one year. Emigration of naturally spawned coho smolts usually occurs between February and June.

III. Effects of the proposed project

The existing ditch is currently without any screening device to prevent access by the fish species of concern, leading to probable fish mortality at some point along the ditch system. It is currently unknown as to the numbers of juveniles lost due to ditch operations. In any case, juvenile salmonids have been found in the ditch, and all efforts should be undertaken to prevent fish losses due to ditch operations. This project will eliminate ditch mortality of steelhead and coho juveniles below the proposed screen structure site.

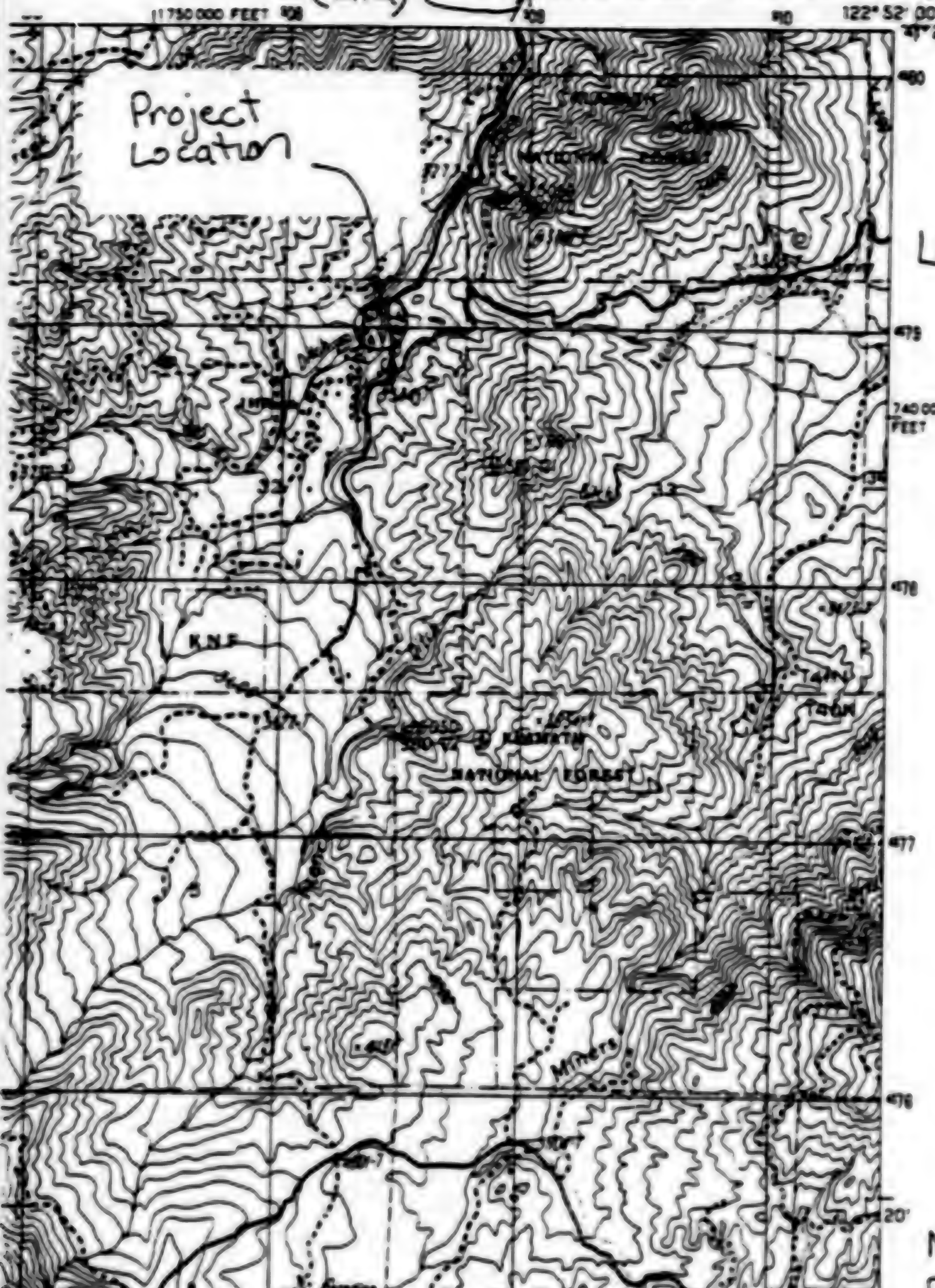
IV. Screen Site Operations

Steelhead and coho juveniles are present in French Creek when the ditch is opened for irrigation purposes in early spring. The ditch is capable of diverting approximately 6 cfs. French Creek habitat conditions within stream reaches above and below the point of diversion support steelhead and coho juvenile rearing throughout the year. A bypass system at the screen site will return juveniles to suitable habitat approximately 600 feet downstream of the point of diversion.

Only during those years of extremely low rainfall and extended drought conditions does French Creek become intermittent resulting in marginal fish habitat for juvenile rearing. For this reason, it is believed a bypass facility without incorporating a trapping facility will be adequate to assure survival of juveniles during the irrigation season because of adequate habitat available at the bypass outlet. In the case of a low water year and poor habitat conditions exist at the bypass outlet, trapping of juveniles that enter the ditch may be advisable. California Department of Fish and Game (CDF&G) personnel will make these assessments on a year to year basis and advise the ditch operator if the fish bypass should not be utilized for returning fish to French Creek. CDF&G will initiate trapping at the screen site if number of juveniles entering ditch warrant the effort. CDF&G will determine a suitable release site for trapped fish collected in the ditch.

French Cr. Rd.
to Hwy 3
(Etna)

EATON PEAK QUADRANGLE
CALIFORNIA – SISKIYOU CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



Location Map

1" = 2000'

N. MacGowan
Fish Screen
3/97

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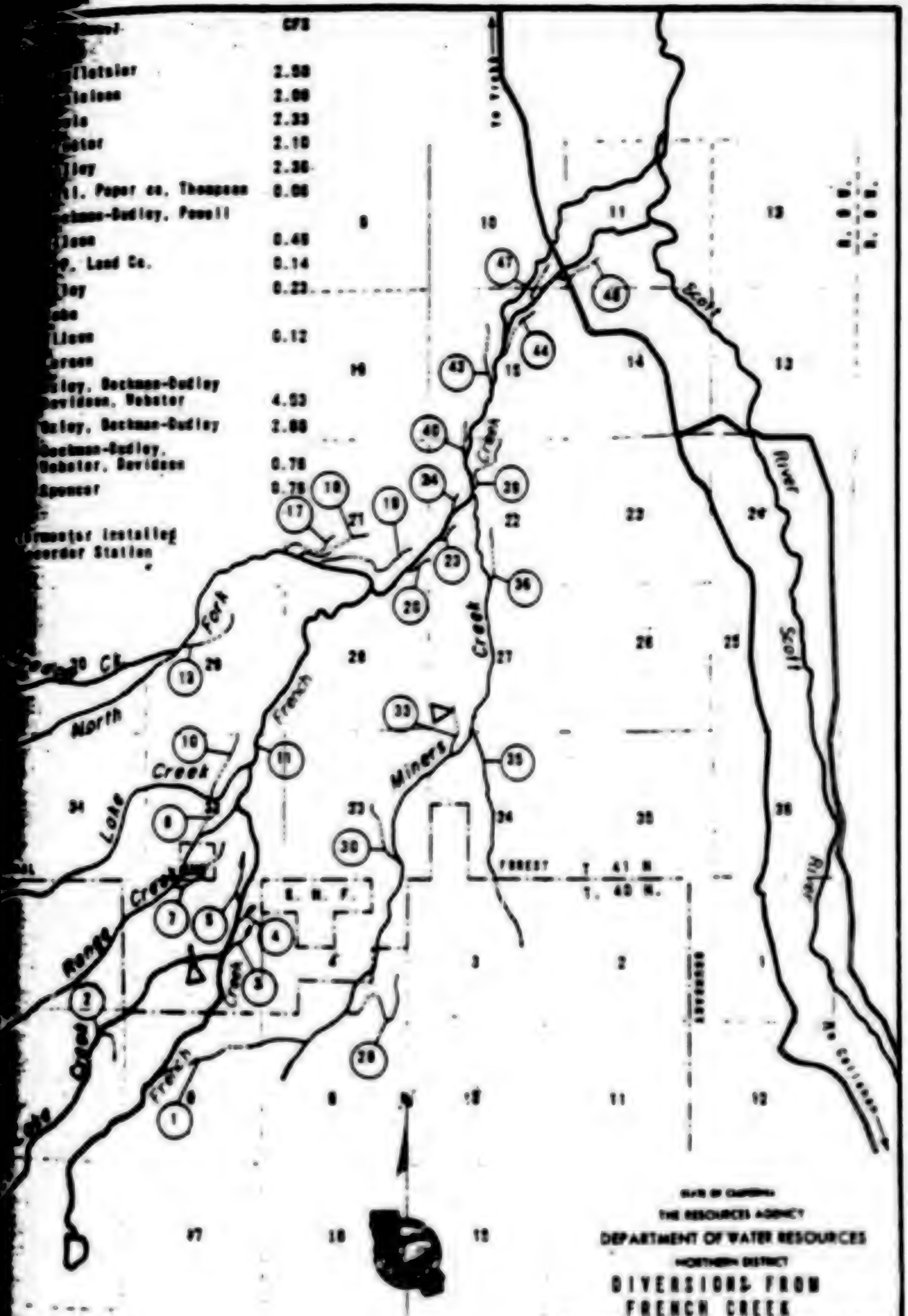
Figure 8

med	CFS
lotsier	2.50
leison	2.00
le	2.33
ector	2.10
lley	2.36
l. Paper co. Thompson	0.06
ckman-Dudley, Powell	
lson	0.45
P. Land Co.	0.14
lley	0.23
abe	
Lison	0.12
erson	
ley, Beckman-Dudley Davidson, Webster	4.53
aley, Beckman-Dudley	2.00
Beckman-Dudley, Webster, Davidson	0.78
Spencer	0.75

rmaster Installed
corder Station



STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
NORTHERN DISTRICT

DIVERSIONS FROM
FRENCH CREEK
WATERMASTER SERVICE AREA

Scale

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U.S DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
CALIFORNIA

PRACTICE REQUIREMENTS
FOR
587C - STRUCTURE FOR WATER CONTROL
FISH SCREENS

For: Business Name MacGowan/Davis Ranch

Job Location Miner's Creek Road/Scott Valley

County Siskiyou RCD Siskiyou Farm/Tract No.

Referral No. Prepared By AP/[illegible]/LB Date 3/98

IT SHALL BE THE RESPONSIBILITY OF THE OWNER TO OBTAIN ALL NECESSARY PERMITS AND/OR RIGHTS, AND TO COMPLY WITH ALL ORDINANCES AND LAWS PERTAINING TO THIS INSTALLATION.

Installation shall be in accordance with the following drawings, specifications and special requirements. NO CHANGES ARE TO BE MADE IN THE DRAWINGS OR SPECIFICATIONS WITHOUT PRIOR APPROVAL OF THE NRCS TECHNICIAN.

1. Drawings, No. 12-12 Y-98-3
2. Practice Specifications: 701
3. Fish Species: Coho, Steelhead,
4. Special Requirements: all [illegible] painted
5. Special Maintenance Requirements: 10 yr. life

NRCS, CA
July 1997

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PRACTICE APPROVAL:

Job Classification: (Ref: Section 501 NEM)

Show the limiting elements for this job. This job is classified as, Class VI

Limiting elements:	Units
Maximum Diverted Flow	[illegible] 4.5 cfs ~~gpm~~

Design Approved by: ____________ Date: 8-13-99
STATE CONSERVATION ENGINEER

LANDOWNER'S/OPERATOR'S ACKNOWLEDGEMENT:

The landowner/operator acknowledges that:

a. He/she has received a copy of the drawings and specification, and that he/she has an understanding of the contents, and the requirements.

b. He/she has obtained all the necessary permits.

c. No changes will be made in the installation of the job without prior concurrence of the NRCS technician.

d. Maintenance of the installed work is necessary for proper performance during the project life.

Accepted by: ____________ Date: ____________

PRACTICE COMPLETION:

I have made an on site inspection of the site (or I am accepting owner/contractor documentation), and have determined that the job as installed does conform to the drawings and practice specifications.

Completion Certification by:

/s/ ____________ Date ____________

NRCS, CA
July 1997

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NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

STRUCTURE FOR WATER CONTROL

(No.)

CODE 587 CA INTERIM

DEFINITION

A structure in an irrigation, drainage, or other water management systems that conveys water, controls the direction or rate of flow, or maintains a desired water surface elevation.

Scope

This standard applies to the structures normally installed in a well-planned irrigation or drainage system, wildlife facility or other water management systems for the conveyance , flow control, or level regulation of water. It covers the planning and functional design of such water-control structures but not the detailed design criteria or construction specifications for specific structures. It does not apply to structural components of irrigation pipelines or to subsurface drains or grade-stabilization structures (410).

PURPOSES

To control the stage, discharge, distribution, delivery, or direction of flow of water in open channels or water use areas. Also used for water quality control, such as sediment reduction or temperature regulation. These structures are also used to protect fish and wildlife and other natural resources.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies wherever a permanent structure is needed as an integral part of an irrigation, drainage, or other water-control systems to serve one or more of the following functions:

1. To conduct water from one elevation to a lower elevation within, to, or, from a ditch, channel, or canal. Typical structures: drops, chutes, turnouts, surface water inlets, head gates, pump boxes, and stilling basins.
2. To control the elevation of water in drainage or irrigation ditches. Typical structure: checks.
3. To control the division or measurement or irrigation water. Typical structures: division boxes and water measurement devices.
4. To keep trash, debris, or weed seeds from entering irrigation delivery systems. Typical structure: debris screens, fish screens.
5. To control the direction of channel flow resulting from tides and high water or backflow from flooding. Typical structure: tide and drainage gates.
6. To control the level of a water table or to remove surface or subsurface water from adjoining land, to flood land for frost protection or to manage water levels for wildlife or recreation. Typical structures: water level control structures, pipe drop inlets, and box inlets.
7. To provide water control for recreation or similar purposes.
8. To convey water over, under, or along a ditch, canal, road, railroad, or other barriers. Typical structures: bridges, culverts, flumes, inverted siphons.
9. To modify water flow to provide habitat or fish, wildlife, and other aquatic animals. Typical structures: deflectors, chutes, cold water release, or structures to make pools and riffles.

CRITERIA

Structures shall be designed on an individual job basis, or applicable NRCS standard drawings shall be adapted, to meet site conditions and functional requirements. They

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

shall be part of an approved and overall engineering plan for irrigation, drainage, wildlife, recreation, channel improvement, or similar purposes.

The plan shall specify the location, grades, dimensions, materials, and hydraulic and structural requirements for the individual structure. Provisions must be made for necessary maintenance. Care must be used to insure that the area's visual resources are not damaged. If watercourse fisheries are important, special precautions or design features may be needed to insure continuation of fish migrations.

If soil and climatic conditions permit, a protective cover of vegetation shall be established on all disturbed earth surfaces. If soil or climatic conditions preclude the use of vegetation and protection is needed, nonvegetative means, such as mulches or gravel, may be used. In some places, temporary vegetation may be used until permanent vegetation can be established. The structure can be fenced, if necessary, to protect the vegetation. Seedbed preparation, weeding, fertilizing, and mulching shall comply with the instructions in technical guides.

Additional Criteria for Fish Screens

Fish screens shall be designed on an individual job basis to meet site conditions and functional requirements. Fish screen designs must meet the current version of the State of California, Department of Fish and Game, Fish Screening Criteria and the National Marine Fisheries Service, Southwest Region, Fish Screening Criteria for Anadromous Salmonids.

Provisions of fish screens will include return of the fish to the point of diversion in a manner which insures their survival. Provisions for fish trapping need to be considered and incorporated into the design if necessary.

CONSIDERATIONS

Water Quantity

1. Effects on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.
2. Potential for a change in the rate of plant growth and transpiration because of changes in the volume of soil water.
3. Effects on downstream flows or aquifers that would affect other water uses or users.
4. Effects on the volume of downstream flow that might cause environmental, social or economic effects.
5. The effect on the water table of the field to ensure that it will provide a suitable rooting depth for the anticipated crop.
6. Potential use for irrigation management to conserve water.

Water Quality

1. Effects on erosion and the movement of sediment and soluble and sediment-attached substances carried by runoff.
2. Effects on the movement of dissolved substances below the root zone and to ground water.
3. Short term and construction-related effects of this practice on the quality of downstream water.
4. Effects of water level control on the temperatures of downstream waters for their effects on aquatic and wildlife communities.
5. Effects on wetlands or water-related wildlife habitats.
6. Effects on the visual quality of downstream water resources.

PLANS AND SPECIFICATIONS

Plans and specifications for installing structures for water control shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE SPECIFICATION

587C - STRUCTURE FOR WATER CONTROL
FISH SCREENS

I. SCOPE

The work will consist of furnishing and installing a fish screen to prevent fish, trash and debris from entering the irrigation delivery system. The work will include all the necessary work and fittings installed to the lines, grades and elevations as shown on the drawings.

II. MATERIALS AND PLACEMENT

Pipe and fittings shall conform to the Practice Standard 430 appropriate to the pipe material.

Concrete used in the installation shall conform to the NRCS Construction Specification 701 Concrete.

Earthfill shall conform to the NRCS Construction Specification 703. Earthfill.

Rock riprap shall conform to the NRCS Construction Specification 707. Rock Riprap.

Grouted Rock Riprap shall conform to NRCS Construction Specification 708 Rock Riprap (Grouted).

Geotextile Fabrics shall conform to NRCS Construction Specification 705 Geotextile Fabric.

III. EXCAVATION

Excavation for the installation shall conform to the requirements of the lines and grades shown on the drawings or as staked in the field, and as necessary for safe installation.

IV. INSTALLATION

Pumped diversions which are screened using manufactured, self contained screens, shall be installed in accordance with the manufacturer's recommendations unless otherwise specified. Minimum clearance of one screen diameter from the channel invert and minimum submergence of one screen diameter from the water surface is required. Installation of all other screens shall be as shown on the drawings.

Pipe shall be shop or field fabricated as needed. Field welding of galvanized corrugated metal pipe will not be permitted. Pipe section shall be joined with flanged fittings or coupling bands unless otherwise specified. Pipe shall be bedded or supported as shown on the drawings.

V. WATER CONTROL GATES

Water control gates, when required, shall conform to the details shown on the drawings and shall be installed according to the manufacturer's recommendation.

VI. BACKFILL

Backfill material shall contain no rocks greater than 2 inches. Compaction shall be accomplished by means of hand tamping or manually directed power tamper, or plate vibrators. Fill shall be placed in approximately horizontal layers. Fill shall be placed in layers not more than 4 inches thick before compaction, and in a manner which will prevent damage to the conduit. The height of the fill adjacent to the conduit shall be increased at approximately the same rate on all sides. Water shall be added to the fill material, if necessary, to obtain the proper moisture for compaction; the material shall retain a ball shape when squeezed in the hand.

VII. VEGETATIVE COVER

Unless otherwise specified, a protective cover of vegetation shall be established on the disturbed area. The planting of vegetative materials shall conform to the requirements of Practice Specification 342, Critical Area Planting.

NRCS, CA
July 1997

accumulation can cause significant injury to fish. Debris type and quantity vary seasonally so a suitable schedule should be developed.. Remove any debris that may accumulate on or in the immediate area of the structure. Remove debris from bypass downwells, bypass entrances and exits, trash racks and along the screen face.

Components must be greased (with environmentally benign grease) on a regular basis. Screen seals must be checked frequently for wear and replaced as needed. Sediment should be removed before it starts passing through the seals.

All screens:

All fences, railings, and/or warning signs shall be maintained to provide warning and/or prevent unauthorized human or livestock entry.

Maintain vigorous growth of vegetative coverings. This includes reseeding, fertilization and application of herbicides when necessary. Periodic mowing may also be needed to control height.

Make sure that all structural drains are functional.

Settlement or cracks in the soil weaken earthen sections and may accelerate the development of flow paths which may result in structure failure. This should be investigated to determine the cause and immediately repaired.

Check concrete surfaces for accelerated weathering, spalling, settlement, alignment or cracks.

Check metal surfaces for rust and other damage, especially sections in contact with earthfill and with other materials. Repair or replace damaged section and apply paint as protective covering.

Eradicate or otherwise remove all rodents or burrowing animals. Immediately repair any damage caused by their activity.

Immediately repair any vandalism, vehicular, or livestock damage to the structure, and any appurtenances.

Other items specific to your project are listed on the "Practice Requirement" sheet.

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION CONSTRUCTION SPECIFICATION

701 - CONCRETE

I. SCOPE

Concrete work shall consist of furnishing and placing concrete to the dimensions, lines and grades as shown on the drawings. Concrete strength shall be 3,000 psi at 28 days or as specified in the Construction Requirements. Proportioning given below will be accepted as meeting this strength requirement.

II. MATERIALS

Cement

Portland cement shall conform to the requirements of ASTM Designation of C-150 and shall be Type II unless otherwise specified and shall be free of lumps and partially set masses.

Water

Shall be free from acid, alkali, oils or organic matter.

Aggregate

Shall be clean, hard, strong and durable, free from dirt and other substances deleterious to concrete. The fine and coarse aggregates shall be a well graded mix approved by the Engineer. The maximum size of aggregate shall not exceed one and a half inches and conform to the requirements of ASTM C-33.

Entrained Air

May be used; however, the air content shall not be more than six percent.

Reinforcing Steel

Reinforcing steel shall be deformed bars conforming to the requirements of ASTM Designation A-615, A-616 and A-617. Fabricated deformed steel bar mats shall conform to ASTM Designation A-184. Plain steel welded wire reinforcement shall conform to ASTM Designation A-185. Deformed steel welded wire fabric shall conform to ASTM Designation A-497. All reinforcing shall conform to the sizes and shapes shown on the drawings.

Welded wire reinforcing

When used, shall conform to the requirements of the current ASTM Specification A185 and shall conform to the size and types as shown on the drawings.

III. PROPORTIONING

Concrete shall be proportioned to include not more than six gallons of water per sack of cement nor less than five and one half sacks of cement per cubic yard of concrete. Consistency of the concrete shall allow it to be worked into place without segregation, and the slump shall be 3 inches ± ½ inch.

When ready-mixed concrete is furnished, the supplier will provide the owner a delivery ticket that shows: time of loading; quantity of materials used, including any admixtures; revolution counter reading at time of loading.

IV. MIXING

Mixing shall be continued for not less than one and a half minutes after all materials, including water, have been added. Each batch shall be completely discharged before the mixer is recharged.

V. FORMS

Forms shall conform to the shapes, lines, and dimensions as shown on the drawings. They shall be braced and/or tied together so as to maintain position and shape and be sufficiently tight to prevent leakage of mortar. Forms shall be thoroughly covered with a form release agent or wetted and cleaned of debris prior to placement of concrete.

Forms shall not be removed without the approval of the Engineer.

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at not less than 50° F nor more than 90° F for the duration of the curing period.

C. Methods of insulating, housing, and heating the structure shall conform to "Recommended Practice for Cold Weather Concreting", ACI Standard 306.

D. The use of accelerators or antifreeze compounds will not be allowed.

E. When dry heat is used to protect concrete, means of maintaining an ambient humidity of at least 40 percent shall be provided unless the concrete has been coated with a curing compound or is covered tightly with an approved impervious material.

XI. CONCRETING IN HOT WEATHER

When climatic or other conditions are such that the temperature of concrete may reasonably be expected to exceed 90° F at the time of placement, or during the first 24 hours after placement, the following provisions also shall apply:

The temperature of the concrete shall be maintained below 90° F during mixing, conveying, and placing. Methods used shall conform to "Recommended Practice for Hot Weather Concreting", ACI Standard 305.

Exposed concrete surfaces which tend to dry or set too rapidly shall be continuously moistened by means of fog sprays or otherwise protected from drying immediately after placement.

Concrete surfaces exposed to the air shall be covered as soon as the concrete has hardened sufficiently and shall be kept continuously wet for at least the first 24 hours of the curing period, and for the entire curing period unless curing compound is applied as specified in Section IX.

If moist curing is discontinued before the end of the curing period, curing compound shall be applied immediately.

XII. STRUCTURE DRAINAGE

Graded sand and gravel filters or filter drains shall be constructed as shown on the drawings or as staked in the field.

Trenches for the filter drains shall be excavated to lines, shape and dimensions shown on the drawings. The sand and gravel shall be placed and tamped in place to the dimensions shown. When drain pipes are used, they will be installed on line and grade without displacement due to placement of filter material.

The filter material shall conform to the following gradation unless otherwise specified.

U.S. Standard Sieve Size	Percent Passing
2"	85-90
3/4"	50-90
16	15-50
Less Than 16	0-15

XIII. STRUCTURAL BACKFILL

The work shall consist of all earthfill adjacent to the structures.

Materials

The fill materials shall be the inplace excavated materials unless otherwise stated and shown on the drawings.

Placement

The fill shall be placed so that the distribution of materials will be to the limits shown on the drawings and shall be free from lenses, pockets, streaks, or layers of material differing substantially in texture or gradation from the surrounding material. No fill shall be placed upon a frozen surface nor shall snow, ice or frozen material be incorporated in the fill.

Fill shall not be placed until the following time has elapsed after concrete placement:

ENGINEER'S COST ESTIMATE

STRUCTURE FOR WATER CONTROL (CONCRETE)

Materials:		
Plywood and 2x4's for forms construction	$500.00	
ft. Rebar @ $1.00/lb	250.00	
4 Yards of concrete @ $80.00/cubic yard	320.00	
Misc. materials, nails, wire	500.00	
Equipment:		
Backhoe for site preparation remove, replace and site clean-up 2 days@ $400/day	800.00	
Labor:		
Forms construction/tear down 80 hours	800.00	
Concrete pour 2 people 1 day	400.00	
Subtotal:		3570.00

FISH SCREEN

Materials:		
1.5 4x8 stainless steel screen panels	500.00	
Gearbox	500.00	
Frame and Paddle Wheel	1500.00	
Brushes	100.00	
Labor:		
Fabrication 80 hours @ $34.50/hr	2070.00	
Installation 80 hours @ 15.00/hr	1200.00	
Subtotal:		5,870.00

FISH BYPASS

Materials:		
30 Feet 12" CSP at $8.33/ft	250.00	
Misc. metal fasteners	200.00	
Labor:	160.00	
Subtotal:		610.00
Misc.		500.00
Totals:		10,550.00
Grand Total:		

(Bemrod Ditch)
MacGowan Ditch | diversion 11-FC | Sheet 1 of 13

1. Determine location of structure

Adjudicated flow is 2.30 cfs.

However, it is possible that higher flows pass through the diversion ditch during high winter/spring events and during the first few weeks after the water user opens the ditch.

In fact, the beginning of the ditch is at such an elevation that it is not possible to shut the ditch off completely during non-irrigation season. A control gate at the beginning of the ditch is not feasible due to the unstable nature of takeout locations on high energy streams. The takeout location migrated upstream due to channel changes in 1997.

Currently the ditch carries water year round up to a control gate about 100 yards downstream from the current takeout location. The gate is closed in the winter to prevent water from going further down the ditch. The diverted water is returned to French Creek through an open rectangular flume.

The elevation of the ditch remains fairly even (S=0.015) up to and past the current control gate. French Creek drops about 11 ft over 230 ft (S=0.05).

Alternative screen locations were reviewed.

Location	+ Advantages	− Disadvantages
A. At takeout	• no bypass necessary	• wide ditch entrance • flood prone area • unconsolidated soils • access difficult
B. Between takeout and current structure	• short bypass	• no posts at bypass location • unstable levee • unconsolidated soils • access difficult
C. Current structure location	• easy access • established bypass location • short bypass	• large bypass elevation drop
D. Downstream of current structure	• bridge limits flood damage DS	• bedrock between ditch + creek • length of bypass increases • access difficult

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7/28/99

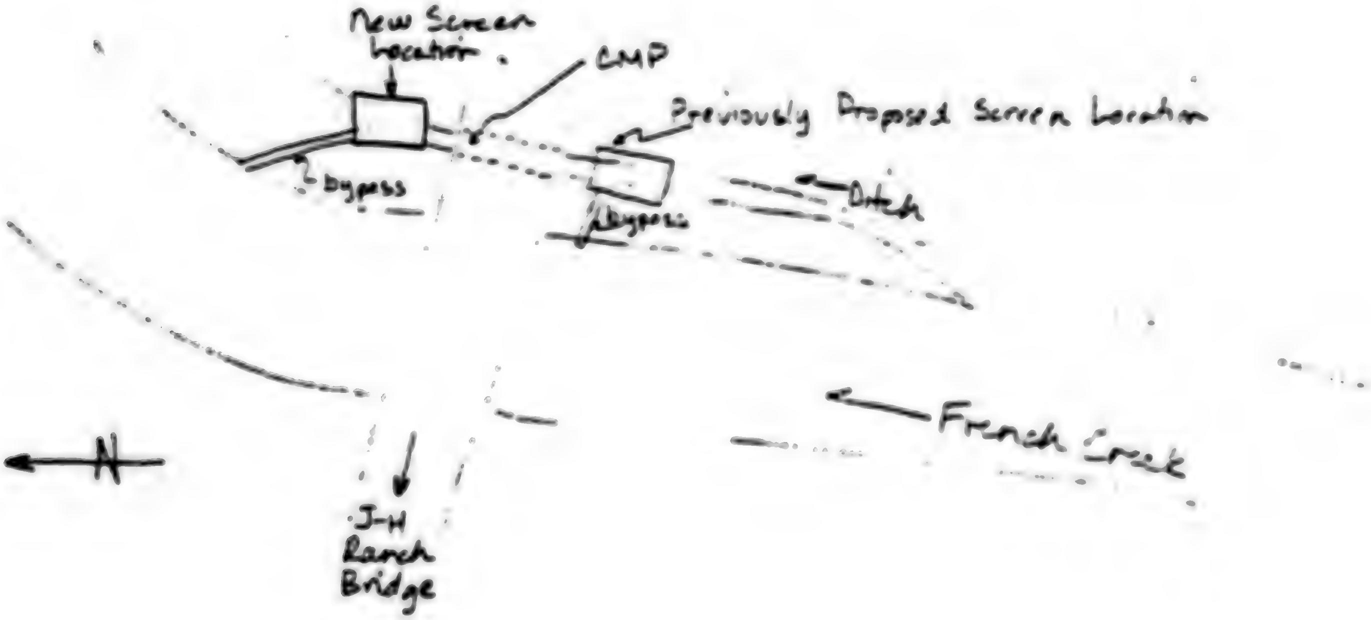
MacGowan Ditch (Bemrod Ditch) 2a 13

Location of structure will be downstream of bridge, within 100 feet of the original design placement.

This decision was based on field visit by Ron Dobson, CDFG, Yreka Fish Screen Shop and Rick Wantuk, NMFS, Santa Rosa Office on 5/21/99.

Bypass slope is ≤ 0.18. Flood flows are diverted US of proposed site by closing off culvert on US side of bridge. (See sketch below). The bypass outfall has an adequate pool year round.

No upstream control will need to be constructed to control water flow.



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2. Determine max flow to pass through screen structure based on wateruser currently using 4" water depth just DS of existing headgate.

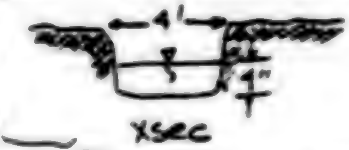
Use mannings equation $Q = \frac{1.49}{n} R^{2/3} A S^{1/2}$

$A = bh = 4' \times \left(\frac{4"}{12"}\right)' = 1.32\,ft^2$

$P = b + 2h = 4' + 2\left(\frac{4"}{12"}\right)' = 4.7\,ft$

$R = \frac{A}{P} = \frac{1.32\,ft^2}{4.7\,ft} = 0.28\,ft$

S = 0.015 from survey
n = 0.0275 dredged channel
width = 4' from survey
depth = 4" water user



$Q = \frac{1.49}{0.0275}(0.28)^{2/3}(1.32)(0.015)^{1/2}$

$= 54.2(0.43)(1.32)(0.12)$

$= 3.7$ cfs

$\boxed{Q = 3.7\,cfs}$

Flows measured in ditch 2/2/98 were 6 cfs. Capacity of ditch is greater than current water use. To reduce cost of fish screen, use current water use as Design Flow.

Ensure excess flow is returned to French Creek. Ditch capacity estimated at 7-8 cfs.

3. Determine flow required for bypass

Given: water depth in bypass ≥ 1.8"
diameter of bypass pipe ≥ 10"

(See sheet 5a for calcs)

Q (cfs)	y_n (in)
0.76	1.8
→ 0.95	2.0

2.0" > 1.9" OK!

However, $y_c > y_n$, supercritical flow

Ensure that condition won't exist for $y_n \rightarrow y_c$
to prevent unstable behavior

D = 12"
S = 0.2"
n = 0.01 (CPP)

Q (cfs)	y_n (in)	y_c (in)
0.3	1.2	2.7
1.0	2.0	4.9
2.0	2.8	7.2

As Q↑, y_n does not approach y_c

OK

Use $Q_{bypass} = 1.0$ cfs

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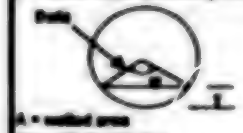
Determine Q given a normal depth of y

n	D (ft)	y (in)	y (ft)	theta	A (ft^2)	P (ft)	R (ft)	S	Q (cfs)
0.01	1	1.80	0.150	1.591	0.0739	0.7141	0.103	0.1	0.76
0.01	1	2.00	0.167	1.682	0.0869	0.7454	0.115	0.1	0.95
0.01	1	2.20	0.183	1.770	0.0987	0.7739	0.128	0.1	1.17
0.01	1	2.30	0.192	1.813	0.1052	0.7872	0.134	0.1	1.29
0.01	1	3.00	0.250	2.094	0.1535	0.8660	0.177	0.1	2.27
0.01	1	4.00	0.333	2.462	0.2292	0.9429	0.243	0.1	4.19
0.01	1	5.00	0.417	2.807	0.3090	0.9860	0.314	0.1	6.72

VARIABLES

Q = flow through circular bypass
n = Manning's roughness factor
D = diameter of circular bypass pipe
y = normal depth (assuming uniform flow)



A = wetted area
P = wetted perimeter
R = hydraulic radius
S = friction slope (assume pipe slope)
E = energy

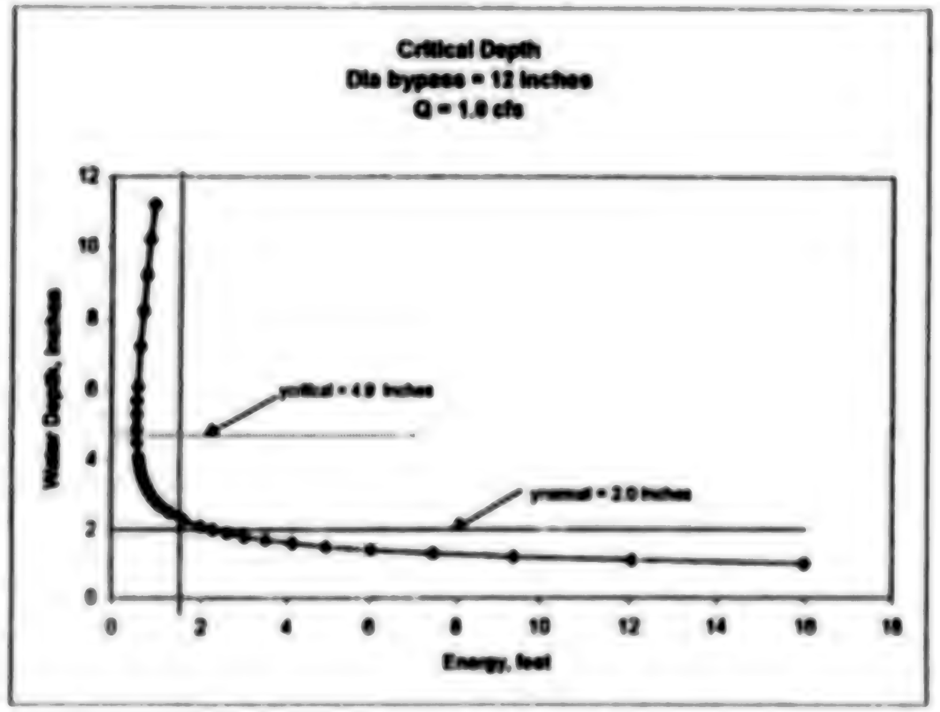
EQUATIONS

Theta = 2*ACOS(1-2*y/D)
A = D^2/8*(theta-SIN(theta))
P = D*SIN(theta/2)
R = A/P
Q = (1.486/n)*A*R^.67*S^0.5
E =

Determine critical depth for specific Q and D

Diameter bypass pipe	1	ft	=	12 inches
Q through bypass	1	cfs		

y (in)	y (ft)	theta	A (ft^2)	E (ft)	y normal (in)
				0	2
1	0.083	1.171	0.031	15.873	2
1.1	0.092	1.230	0.036	12.083	2
1.2	0.100	1.287	0.041	9.364	2
1.3	0.108	1.342	0.046	7.456	2
1.4	0.117	1.394	0.051	6.033	2
1.5	0.125	1.445	0.057	4.981	2
1.6	0.133	1.495	0.062	4.140	2
1.7	0.142	1.544	0.068	3.501	2
1.8	0.150	1.591	0.074	2.995	2
1.9	0.158	1.637	0.080	2.591	2
2	0.167	1.682	0.086	2.264	2
2.1	0.175	1.726	0.092	1.997	2
2.3	0.192	1.813	0.105	1.584	2
2.5	0.208	1.896	0.118	1.313	2
2.7	0.225	1.977	0.132	1.113	2
2.9	0.242	2.056	0.146	0.968	2
3.1	0.258	2.133	0.161	0.859	2
3.3	0.275	2.208	0.176	0.779	2
3.5	0.292	2.282	0.191	0.718	2
3.7	0.308	2.355	0.206	0.675	2
3.9	0.325	2.426	0.221	0.642	2
4.1	0.342	2.497	0.237	0.618	2
4.5	0.375	2.636	0.269	0.590	2
4.9	0.408	2.773	0.302	0.579	2
5.3	0.442	2.908	0.334	0.580	2
5.7	0.475	3.042	0.368	0.590	2
6.1	0.508	3.175	0.401	0.605	2
7.2	0.600	3.544	0.492	0.664	2
8.2	0.683	3.882	0.572	0.731	2
9.2	0.767	4.237	0.646	0.804	2
10.2	0.850	4.692	0.712	0.881	2
11.2	0.933	5.238	0.763	0.960	2



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Sheet 5a of 13

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22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS

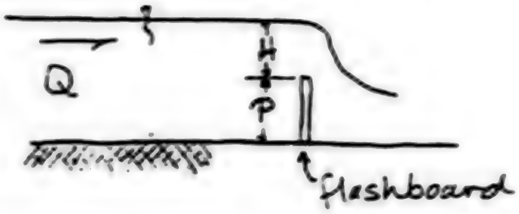
4. Determine backwater effects at DS control

Use sharp crested weir

$Q = K\sqrt{2g}\,LH^{3/2}$ $\qquad K = 0.4 + 0.05\left(\frac{H}{P}\right)$

L - width into paper

(See sheet 7 for calcs)



* With one 2" × 6" × 1.5', one 2" × 3" × 1.5' flashboard at design flow of 3.7 cfs for WSE of 1.52'.

The ditch will not support a WSE of more than 1.5 ft. However, these calculations assume that the water can only flow over the flashboard / weir.

In reality, water will flow through width of paddle wheel also.

Note: if WSE is higher than paddle wheel paddle, even more flow will pass over paddle wheel paddle.

→ Therefore, DS flashboard / weir will not have WSE as high as calculated.

US ditch dimensions dictate how high WSE can be at DS flashboard / weir. The backwater effects will continue for at least 500 ft (based on GVF calcs), which is beyond the take out for the diversion.

$\boxed{\text{Therefore, use a screen height of 1.5' max and wall height of 1.75'.}}$

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(Bemrose Ditch)
MacGowan Ditch 1 diversion 11-FC sheet 7a of 13

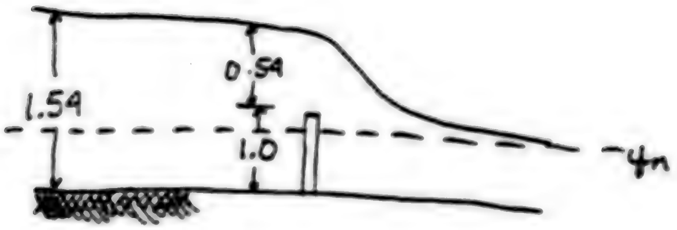
WEIR calculations

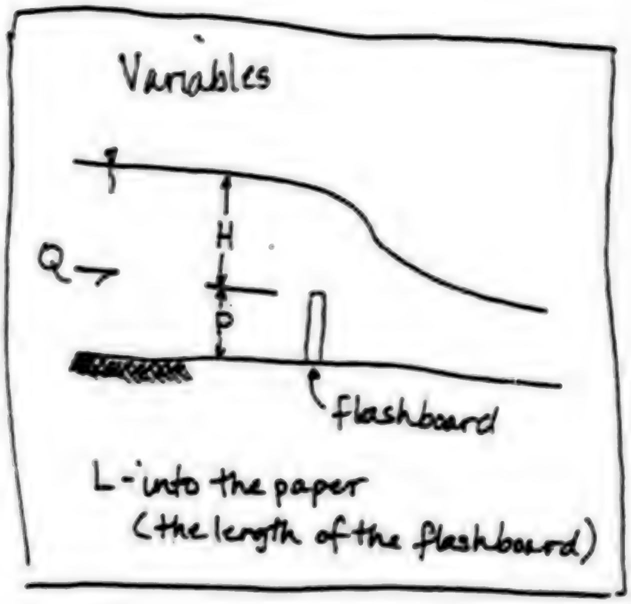
Used Solver in Excel 98 to find H at fixed P, L, Q
$Q = K*sqrt(2*g)*L*H^1.5$
$K = 0.4 + 0.05*(H/P)$
Hydraulic Engineering, Roberson, Cassidy, and Chaudhry, 1988.

P (ft)	H (ft)	L (ft)	Q (cfs)	total WSE
0.50	0.53	2.7	3.7	1.03
0.75	0.54	2.7	3.7	1.29
1.00	0.54	2.7	3.7	1.54
1.25	0.55	2.7	3.7	1.80

Use L = 2.7 ft
P = 1.0 ft

for WSE 1.54 ft





L - into the paper
(the length of the flashboard)

y_n = 11.5" for b = 2.7 ft (width of channel)
S = 0.0015
Q = 3.7 cfs
n = 0.0275

y_n < flashboard height ∴ weir is not submerged
↳ no flow reduction due to submergence

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5. Determine size of screen

Given: $Q_{max} = 3.7$ cfs ($Q_{bypass} = 0.5$ cfs)

$V_{approach} \leq 0.4$ ft/s

$Q/V = A$ $\quad Q_m/V_a = A_{min}$ $\quad 3.7 \text{ cfs} / 0.4 \text{ ft/s} =$ $\quad \text{ft}^2$

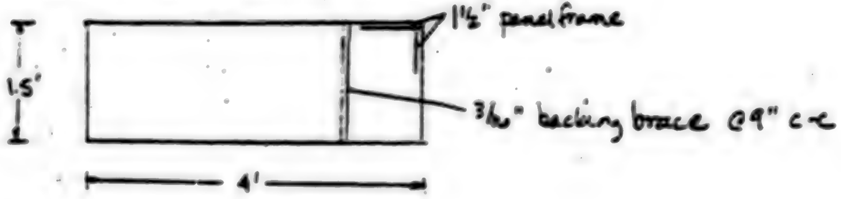
$$\boxed{A_{min} = 9.3 \text{ ft}^2}$$

WSE with flashboards is ~ 1.5'
* However true WSE will be lower since flow travels thru paddle wheel also.

Use 1.5' high screens

4' wide screens (based on available material)

check effective screen area



ONE SCREEN

	$4'(1.5')$ ft²		6 ft²
horizontal panel frame	$-(1\tfrac{1}{2})" \times 2\,(4')$	→	− 1 ft²
vertical panel frame	$-(1\tfrac{1}{2})" \times 2\,(1.5'-3")$		− 0.3125 ft²
backing brace	$-(3/16") \times 4\,(1.5'-3")$		− 0.078 ft²
			4.6 ft²

$$\boxed{A_{effec}/_{screen} = 4.6 \text{ ft}^2}$$

Determine number of screens necessary

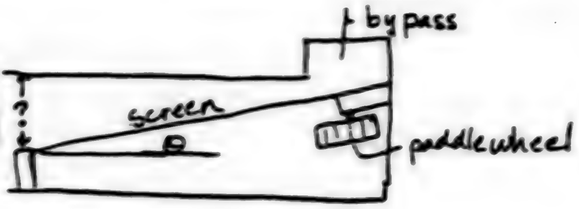
$$\# \text{ screens} = \frac{A_{min}}{A_{effec/screen}}$$

$$= 9.3 \text{ ft}^2 / 4.6 \tfrac{\text{ft}^2}{\text{screen}} = 2.02 \text{ screens}$$

$$\boxed{\text{Use } 3 - 1.5' \times 4' \text{ screens}}$$

6. Determine size of entrance and angle of screen

Use θ = 0° for ease of construction



Use 2 ft width for opening to box since existing cross section is 3'-5' wide

22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS

Check V_a

$$V_a = Q/A_{total\ effect}$$

$$= 3.7\,cfs / 13.8\,ft^2$$

$$= 0.27\,ft/s$$

$\boxed{V_a \leq 0.4\,fps \text{ OK}}$

*Assume V_a is 3 inches from screen

---

consider screen is 3 3/16" from bottom of structure

$$\text{area loss} = 3\tfrac{3}{16}''\left(\tfrac{1'}{12''}\right) \times 12'$$
$$= 3.2\,ft^2$$

Previous area calculated = 13.8 ft²
− 3.2 ft²
10.6 ft²

Check V_a : $Q/A_{effec} = 3.7\,cfs / 10.6\,ft^2$
$= 0.35\,ft/s$

$\boxed{V_a < 0.4\,ft/s \text{ OK}}$

* This also allows over 3" freeboard

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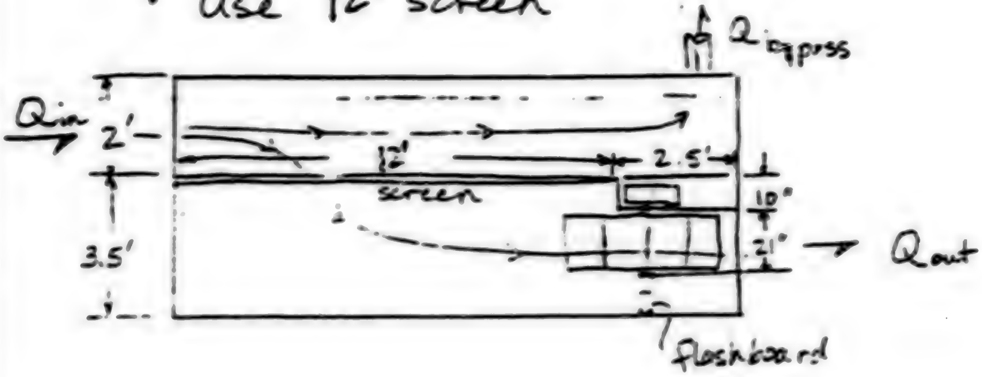
22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS

7. Determine width of structure

- Use 10" wide gearbox wall - standard CDFG
- Use 18" x 16" paddle on 3½' diameter paddle wheel
- Use 6' max structure width
- Use 12' screen



Limitations

- with no screen angle, structure = wide
- structure exit has 21" paddle wheel width + 10" gearbox wall that reduces total exit width
- don't want to reduce entrance width any more
- still need some control at exit
- use whatever space is left over at exit as WSE control by inserting flashboard. Flashboard may not serve as weir but as dam during low flow

Note: previous WSE with 1' wide flashboards not valid

However, use WSE for calculations anyway. This WSE can be maintained with paddlewheel at 16" high and flashboard adjustment.

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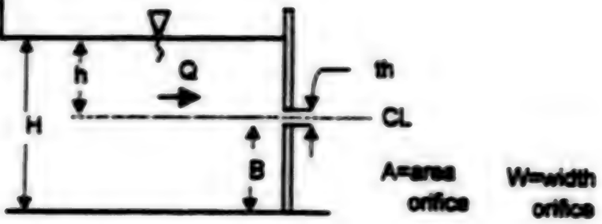
Need structure to control flow into bypass pipe.

Use orifice in flashboards.

Design WSE = 1.5 ft = H =	16.8 inches
Q bypass =	1 cfs
D bypass =	12 inches

$$Q = CA\sqrt{2gh}$$

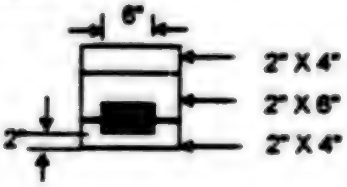
$$A = \frac{Q}{C\sqrt{2gh}}$$



condition: β = th/H where $0.2 \leq \beta \leq 0.8$
and $B \geq 0.5"$

th (in)	β = th/H	C	B (in)	h = H-B-th/2 (in)	A (ft^2)	A (in^2)	W = A/th (in)
2	0.12	0.6					
3	0.18	0.6					
4	0.24	0.6	4	10.8	0.22	32	7.9
5	0.30	0.6	2	12.3	0.21	30	5.9 ***
6	0.36	0.6	0	13.8	0.19	28	4.6

Use two 4" high and one 6" high flashboard with
6" X 5" orifice
Be sure orifice is 2" above slab elevation



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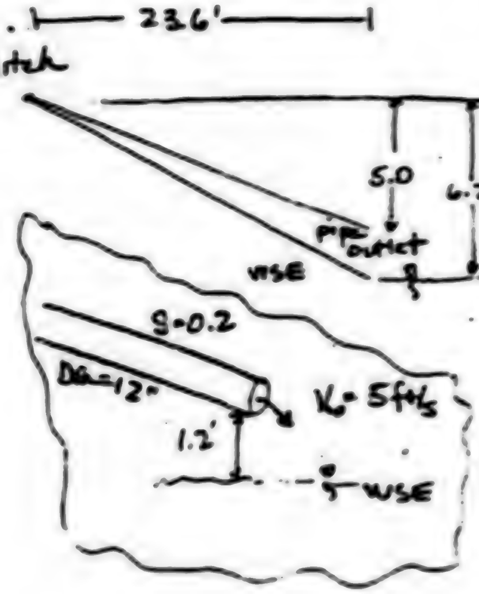
22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS

9. Check impact velocity of fish striking pool since there is a fall of over 1 foot.

$V_{impact} < 25$ ft/s



$V_{in pipe} = Q_{bypass} / A_{wetted}$

$= 0.5 \text{ cfs} / 0.1 \text{ ft}^2 = \underline{5 \text{ ft/s}}$

5 ft/s > 4 ft/s
bypass outfall requirement.

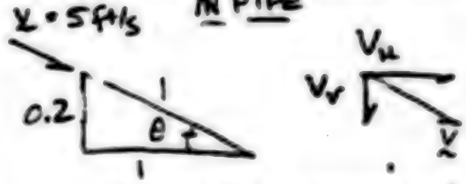
5 ft/s > 2 ft/s
pipe velocity requirement

From kinematics:

V_0 $\quad V_{H_0} = |\underset{\sim}{V}| \cos\theta \approx |\underset{\sim}{V}| = \underline{5 \text{ ft/s} = V_{H_0}}$

$V_{v_0} = |\underset{\sim}{V}| \sin\theta = 5 \text{ ft/s} (0.2)$ $\underline{1 \text{ ft/s} = V_{v_0}}$

IN PIPE



small angle approximation
$\sin\theta \approx \theta$
$\theta = 0.2$

assume gravity constant

$V_v^2 = V_{v_0}^2 + 2ay$

$= (1 \text{ ft/s})^2 + 2(32.2 \text{ ft/s}^2)(1.7')$

$= 110 \text{ ft}^2/\text{s}^2$

$\underline{V_v = 10.5 \text{ ft/s}}$

$y = 1.2' + 0.5'$
$= 1.7'$

$|\underset{\sim}{V}_{impact}| = \left[(10.5 \text{ ft/s})^2 + (5 \text{ ft/s})^2\right]^{1/2}$

$= 11.6$ ft/s

$\boxed{|\underset{\sim}{V}_{impact}| = 11.6 \text{ ft/s} < 25 \text{ ft/s} \quad \text{OK}}$

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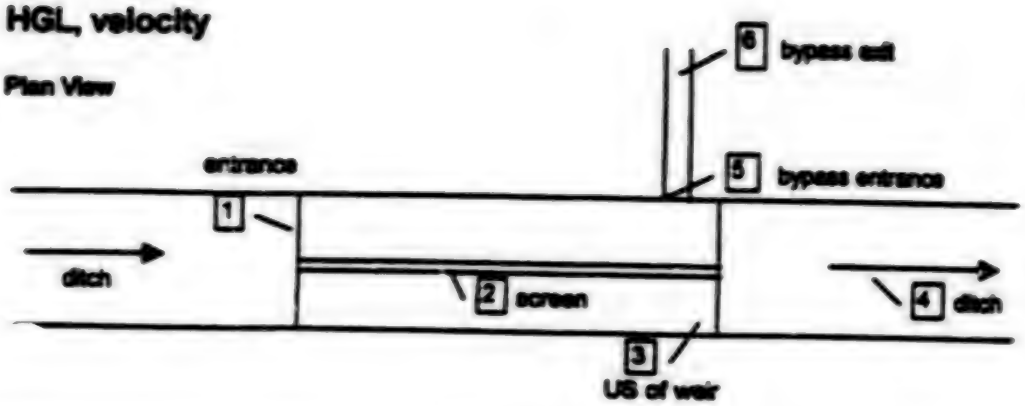
Sheet 13b of 13

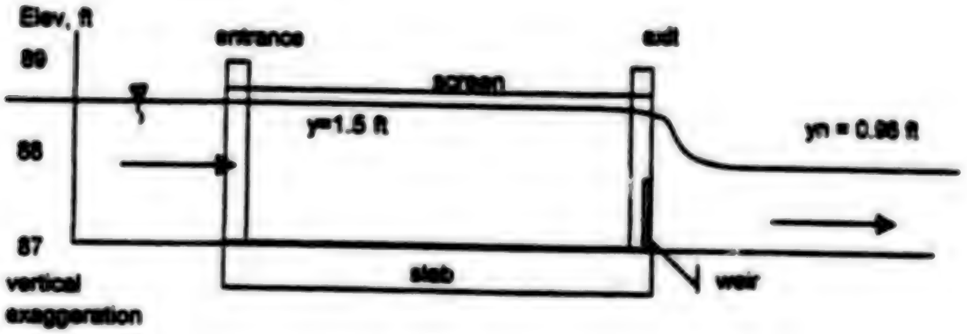
HGL, velocity

Plan View



	Section					
	entrance	screen	US of weir	ditch	bypass ent	bypass exit
Section #	1	2	3	4	5	6
V (ft/s)	1.6	0.3	0.9	1.0	4.8	11.6
Q (cfs)	4.7	3.7	3.7	3.7	1.0	1.0
A (ft²)	3.0	10.6	4.1	3.8	0.2	0.1
		(with frame losses)				

HGL, side view of structure and ditch



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JOB Note: Original unedited survey on file at NRCS
Yreka Field Office

00NM SDR20 V03-05 May-28-99 12:53 122211
10NM MAC8 (MacGowan / Davis Fish Screen) At new location
13CP Sea level crn: N
13CP C and R crn: N
13CP Atmos crn: N
06NM 1.000000
13OO Current view,POS,All POS
13TS May-27-99 11:39
13JS 10000

INSTRUMENT SETUP

01NM 3 020871 00000031 0.00000000
13PC P.C. mm Applied 0.000
02RS 0206 4.75000000
13SC Set #: 1 Stn: 0206 Point count: 2
03NM 5.2

ALL Elev good

CODE	PNTS	NORTHING	EASTING	ELEVATION	DESCRIPTION
~~08TP~~	~~3032~~	~~5002.1538~~	~~4942.833~~	~~99.568669~~	~~TOP VERT BOLT~~
~~08TP~~	~~3033~~	~~5290.52996~~	~~5299.634~~	~~28.305679~~	~~MAILBOX X~~
08TP	1000	5011.63409	4944.339	86.923222	CMP INV
08TP	1001	5007.72944	4922.161	81.671611	WATER EDGE000
08TP	1002	5011.38866	4930.749	85.845164	WATER EDGE000
08TP	1003	5016.72438	4937.563	87.976795	BANK
08TP	1004	5017.45419	4939.3	87.736461	DITCH
08TP	1005	5017.79761	4939.578	86.692287	DITCH
08TP	1006	5019.17935	4942.004	86.703681	DITCH
08TP	1007	5018.77166	4942.51	86.887037	DITCH
08TP	1008	5019.49545	4942.844	87.589591	DITCH
08TP	1009	5020.73443	4944.633	88.29483	BANK
08TP	1010	5024.19083	4951.535	92.403367	BANK
08TP	1011	5031.29943	4937.463	87.331617	DITCH
08TP	1012	5031.03446	4936.992	86.550212	DITCH
08TP	1013	5030.9462	4936.047	86.543704	DITCH
08TP	1014	5028.63867	4934.206	86.59315	DITCH
08TP	1015	5028.37841	4933.656	87.316232	DITCH
08TP	1016	5041.63715	4909.402	81.092656	WATER EDGE...
08TP	1017	5037.52564	4916.541	85.18162	BYPASS
08TP	1018	5027.424	4930.138	87.410116	BYPASS
08TP	1019	5021.39965	4929.277	86.284951	BYPASS
08TP	1020	5016.70404	4918.553	81.317533	BYPASS

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ENGINEERING INDEX PROPERTIES

fish screen

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
106:												
Attar------------	0-23	Very bouldery loamy fine sand	SM	A-1, A-2	15-25	30-50	60-80	60-75	30-60	10-25	---	NP
	23-60	Very bouldery loamy sand, very bouldery sand	SP-SM, SM	A-1	15-25	30-50	60-80	50-75	25-50	5-15	---	NP
120:												
Chain------------	0-4	Gravelly coarse sandy loam	SM	A-1, A-2	0	0-5	80-95	50-75	30-50	15-30	---	NP
	4-34	Gravelly coarse sandy loam	SM	A-1, A-2	0	0-5	80-95	50-75	30-50	15-30	---	NP
	34-38	Weathered bedrock			0	0	0	0	0	0	---	NP
wanakee------	0-16	Gravelly coarse sandy loam	SM	A-1, A-2	0	0-5	80-95	50-75	30-50	15-30	---	NP
	16-20	Weathered bedrock			0	0	0	0	0	0	---	NP
212:												
Riverwash--------	0-60	S tratifiedgravelly	---	---	---	---	---	---	---	---	---	---

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ENGINEERING INDEX PROPERTIES

Endnote -- ENGINEERING INDEX PROPERTIES

This report gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

DEPTH to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given in the published Soil Survey for each soil series under "Soil Series and Their Morphology."

TEXTURE is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Soil Survey Glossary.

lassification of the soils is determined according to the Unified soil classification system and the system dopted by the American Association of State Highway and Transportation Officials.

he UNIFIED system classifies soils according to properties that affect their use as construction material. Soils are lassified according to grain-size distribution of the fraction less than 3 inches in diameter and according to lasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, W, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils xhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

TO system classifies soils according to those properties that affect roadway construction and maintenance. system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven roups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in roup A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 re fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection. If laboratory ata are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group ndex number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

ock FRAGMENTS larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight asis. The percentages are estimates determined mainly by converting volume percentage in the field to weight ercentage.

ercentage of soil particles passing designated sieves (PERCENTAGE PASSING SIEVE NUMBER--)is the percentage of the oil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA tandard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on aboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

IQUID LIMIT and PLASTICITY INDEX (Atterberg limits) indicate the plasticity characteristics of a soil. The stimates are based on test data from the survey area or from nearby areas and on field examination. The estimates f grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, f the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across lassification boundaries, the classification in the marginal zone is omitted in this report.

FISH SCREEN CHECKSHEET
Yreka Field Office

Date 4-22-96

Name MacGowan/ Phelps

Address 6915 Miners Creek Rd.

Individual or group pooling agreement

Ditch or pump French Creek

Diverted flow 2.36 cfs 1062 gpm

Site description @ JH Ranch Bridge

Site visit by NRCS 4-10-96

Comments:

Site review by Fish and Game: Ron Dotson

Signature: Tim Viel
Biologist

4/96

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U S DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

ENVIRONMENTAL EVALUATION 1/

LANDUSER/PROJECT McGowan/Davis
SPONSOR CFSA
DATE 1-31-97
FIELD OFFICE Yreka
COUNTY Siskiyou

ENVIRONMENTAL FACTORS	EFFECT 2/ Without Project	EFFECT 2/ Short Term	EFFECT 2/ Long Term	NOTES 3/
*PRIME/UNIQUE FARMLAND	0	0	0	(I Pasture)
CHANGE IN LAND USE (What is change?)	0	0	0	
SOIL EROSION (Quantify if possible)	0	–	0	
SEDIMENTATION (Quantify if possible)	0	–	0	
SOIL CONDITION (Compaction, salinity, fertility, etc.)	0	0	0	
SURFACE WATER QUANTITY	0	–	–	may restrict flow
SURFACE WATER QUALITY	0	–	0	
SUBSURFACE WATER QUANTITY	0	0	0	
SUBSURFACE WATER QUALITY	0	0	0	
AIR QUALITY	0	0	0	
VEGETATION ALTERATION (What is change?)	0	–	0	during construction
*FLOODPLAIN	0	0	0	↑
*WETLANDS (Includes riparian)	0	–	0	see
FISH AND WILDLIFE HABITAT	–	–	+	screen will protect fish juveniles
*THREATENED OR ENDANGERED SPECIES - Plants or animals	–	–	+	from entering ditch
*CULTURAL RESOURCES	0	0	0	
AESTHETICS (Appearance of landscape)	0	0	0	
ECONOMICS	–	–	–	labor will be landowners resp.
OTHER				

1/ Use for individual practices, RMS, conservation or treatment unit, or EWP, RC&D, small watershed projects (Refer to GM190-410).

2/ CODE ITEMS: (+) Beneficial Effect, (0) No Effect, (-) Adverse Effect, (N/A) Not Applicable. Without Project = What are effects if no project action? Short Term = Installation period. Long Term = Period through duration of intended use, life of project or return to pre-condition. Assess off-site or cumulative impacts, as well as on-site.

3/ Explain all + or - effects and note if on-site and/or off-site.

(*) CRITICAL ENVIRONMENTAL FACTOR addressed in Federal Regulations.

- CONTINUED ON BACK -

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SCS-ENG-6
March, 1973

U.S. Department of Agriculture
Soil Conservation Service

UTILITY CHECK SHEET

Reference Engr. Memo-73

Farm Name MacGowan/Davis Location Miners Creek

Utilities Involved and Location: PP&L along French Creek Rd
JH Ranch bridge

Landowner or operator notified Nancy MacGowan (Who) Ayn Perry (By Whom)

How by this docket Date:

Work to be done concrete pour When:

Utility Company Notified: ________ (Who) ________ (By Whom)

How ________ Date: ________

Request to locate utility ________

Work to be done ________ When: ________

Request for Company representative to be present ________

Utility marked or staked ________ Date: ________

Representative present during construction ________

Contractor Notified: ________ (Who) ________ (By Whom) ________ (How) ________ (Date)

Type of utility ________ Location: ________

Vertical location in relation to work ________

Horizontal location in relation to work ________

Contractor shown markings or stakes ________

Utility location shown on plans ________

Other remarks ________

____
Signature

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SISKIYOU RESOURCE CONSERVATION DISTRICT
P.O. Box 268 Etna, CA 96027
[illegible]
sisqrcd@sisqtel.net

March 1 , 1999

Response to Natural Resource Conservation Service, Weaverville, CA. Rich Robert's comments on MacGowan Fish Screen, letter dated 3/20/98

Design Calculations

Sheets 1-3. The design flow is based on a flow measurement taken on 2/2/98. If flow into the ditch is currently unregulated this may be an excessive flow to design for. I would recommend basing the design flow on the water right and the landowners needs and regulating flow to the screen with the water control structure mentioned in the report.

Response. Design flow has been changed to 4.2 cfs (3.7 for water user, 0.5 for bypass).

Sheet 8. Need to divide backing brace thickness 3/16" by 12 to convert to ft. This would yield a brace area of 0.078 ft^2 and an effective screen area of 4.6 ft^2 per panel, or 18.4 ft^2 total.

Response. Calculation has been adjusted.

Sheet 9. To check approach velocity use the design water surface elevation to determine effective screen area. Because the bottom of the screen open area is 3-3/16" above the floor elevation, the effective screen height (at WSE of 1.38' above the floor) is 1.11'. Therefore the effective screen area is 1.11' x (16' – 16(3/16")/12 – 8(1.5")/12 = 16.4 ft^2.

If the box invert is set at the existing ditch elevation the slab will be 3" below existing grade. This would allow for a higher WSE in the box, which would utilize more of the screen area. If the WSE can be raised to the top of the screen opening, three – 4' x 1.5' screen panels could be used for a total effective screen area of 13.8 ft^2. This would be adequate for a design flow of up to 5.5 cfs.

Response. Calculation has been adjusted.

Sheet 12. Velocity at beginning of screen is 6.5 cfs/(1.38' x 2.5') = 1.88 ft/s. Velocity at end of screen is 0.5 cfs/(1.38' x 2.5') -= 0.14 ft/s. Assume average velocity = (1.88 + 0.14)/2 = 1.0 ft/s. Therefore travel time = 16 ft/(1 ft/s) = 16 s.

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Need to address sweeping velocity Vs. For ditches Vs must be > Va. The velocity at the end of the screen is 0.14 ft/s < 0.4 ft/s. This does not meet NMFS criteria. You would need to reduce the flow width to 10.5" at the end of the screen to meet this criteria.

Response. Method of calculating Vs was followed as in previously approved designs submitted by NRCS state engineer (i.e. Barnes/Tobias ditch, and Wright/Fletcher ditch). Using analysis recommended here, distance between wall and screen would need to be less than 10" for Vs = 0.41 ft/s. This does not allow for removing debris from floor of structure with shovel.

NRCS state engineer used vector analysis to show $\underline{V}in = \underline{V}s + \underline{V}a$. For a non-angled screen, this reduces to $\underline{V}in = \underline{V}s$. Using analysis recommended here, previously approved designs do not meet NMFS criteria and still direct flow to the bypass pipe.

Design Drawing

The scale on all of the drawings seem to be off. If these are photo reductions of 11" x 17" sheets, you need to adjust the scale.

Response. The drawings were photo reductions of 11" x 17" to fit through fax machine. Scales on drawings in report are accurate.

Sheet 2. I believe the horizontal station should be 25' or 0+25 at the end of the pipe.

Response. The horizontal station labels have been corrected.

Sheet 5. Slot type 2, need to design slot such that the boards will not float or slide from side to side.

Response. The strapping used for Slot Type 2 has holes in it to allow for insertion of nails into flashboards. This will secure the board in the slot.

Sheet 10. Don't need drive shaft to extend through paddle wheel if there is not a support wall (see F&G design).

Response. Drive shaft removed from paddle wheel design.

Lorrie Bundy
RCD Project Coordinator

SISKIYOU RESOURCE CONSERVATION DISTRICT
P.O. Box 268 Etna, CA 96027
[illegible] FAX [illegible]
[illegible]

February 12. 1998

Response to California Department of Fish and Game, Yreka, CA, Ron Dotson's comments on MacGowan Fish Screen, letter dated 3/12/98

Comment #1. **Bypass capacity is too small. Recommend using 12 to 16 inch pipe to carry 1/2 the capacity of the ditch, and to better match the flows.**

Response. Twelve-inch pipe is recommended for the bypass. The bypass capacity is ~2.4 cfs (See Calculation Sheet 4). The ditch capacity is ~6 cfs. Construction of an upstream diversion to control flow will ensure excessive flows are not received through the screen structure and bypass. The bypass pipe is designed for a minimum diameter to minimize cost and to minimize bypass flow necessary to maintain minimum water depth in bypass pipe.

Comment #2. **Bypass pipe length is not obvious. Is the length determined? Recommend dropping it as low as possible so it can rest right on the rocks, and possibly eliminate the 1.5-foot drop into the stream. Also wondering why it is pipe, isn't the existing flume system working?**

Response. The bypass pipe length was not clearly shown in calculations or drawings. The pipe length is estimated at ~30 ft.
Bypass pipe slope is already steep (S=0.2). Another 1.5-foot drop would result in slope of 0.3. The increase in slope would require more bypass flow to maintain minimum water depth in bypass pipe. Bypass flow is already 12% of incoming flow (4.2 cfs).
The existing flume does adequately transport water back to French Creek. However, the closed conduit design is modeled after recent CDFG and NRCS work. In addition, there is good opportunity for predation if bypass is open due to the surrounding vegetation and proximity to guest ranch walking paths.

Comment #3. **Paddle wheel - is it aluminum or steel? Recommend aluminum to reduce weight and maintenance.**

Response. Recommended aluminum will be indicated on drawings.

Comment #4. **Flow measurements - check the numbers used to size the box. Where did they come from?**

Response. Initial flow estimate for design was Q=3 cfs based on adjudication records and conversations with water user. Design began for Q=3 cfs. Subsequent review of contract indicated an estimate of 6.5 cfs for ditch capacity. Since

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there is no upstream control structure, the ditch flow was measured and design was then changed to reflect Q=6.5 cfs. However, an upstream control structure will ensure that unnecessary flows are diverted from screen structure and design of Q=4.2 cfs can be used (3.7 cfs to water user, 0.5 cfs to bypass).

Comment #5. Depth of flow - is it going to be adequate to push the paddle wheel around. What about low flow conditions? The water depth may be very shallow at times.

Response. The flashboards will be used to elevate the water depth. The paddle wheel turns easily at the touch of a finger. As long as there is some flow in the ditch, and the water depth is elevated, the flow passing through the paddle wheel is expected to be adequate. However, low flow is not expected to be a problem because there have been adequate seasonal flows historically, as noted in Comment #6.

Comment #6. Design report - remove the comments under Water Quantity about bypass being nonoperational during low flows. Request that we don't suggest blocking the bypass at this site, as there should be water all summer there. This will eliminate the need for ever trapping at this screen.

Response. Comment will be removed since there have been adequate seasonal flows historically. However, if there is an extended drought or unexpected geologic changes, blocking the bypass may then be an issue.

Lorrie Bundy
RCD Project Coordinator

Comments from Marianne Hallet, NRCS, Sacramento on MacGowan fish screen design
Phone conversation 4/99

Comment #1
As a general rule, have the inflow and outflow dimensions of the box the same.

Comment #2
The top of US cutoff wall is different than top of DS cutoff wall.

Response #2
The US cutoff wall is about 2 inches higher than slab to serve as a sand ledge because the ditch transports decomposed granite.

Comment #3
Add note or flag indicating cutoff wall depth, for US & DS

Response #3
There is a note on drawing sheet 3 (note 2) that the "US and DS ends of structure will have a 6" wide cutoff wall extending to 86.5' Elev". However, further clarification on that note was added as " The cut-off walls are 1.5' feet deep. A sand ledge of 0.2 feet is added at the entrance of the box"

Comment #4
The downstream control water depth is not correct with current design. Consider:

- flashboards behind paddle wheel from wall to wall and redo hydraulic calcs;
- installing a wall beyond the paddle wheel.

Response #4
Corrections were made to drawing sheets 3 and 4 indicating flashboard slots from wall to wall near the exit of the box. Corrections were made to calculation sheet 7 indicating new water surface elevation of 1.54 feet using a 2.7 foot wide by 1 foot high flashboard at the exit of the box. The new water surface elevation is about 1/4 inch higher than the previously calculated water surface elevation of 1.52 feet. As a result, no other calculations were affected.

Lorrie Bundy
SiskiyouRCD

Marianne,
is this correct?
I took sketchy notes on the phone.
- Lorrie

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END

DATE FILMED

09/13/02

SCALE
1' = 75'

OVERVIEW

PLAN VIEW
SCALE 1' = 8'

NOTES
1. Bypass Pipe Shall be 12" ID Corrugated Plastic Pipe (CPP)
2. BM ELEV = 100.0', Head of bolt on NE corner of N 6X6 on bridge

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FISH SCREEN
MACGOWAN DITCH

U.S. DEPARTMENT OF AGRICULTURE
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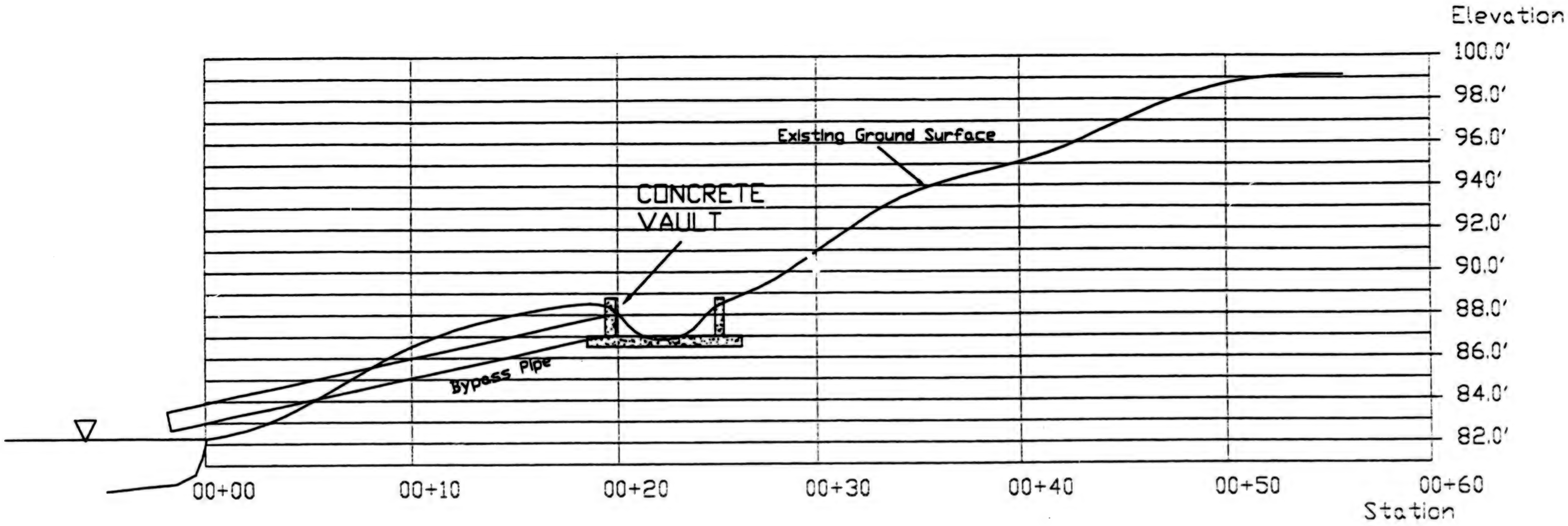
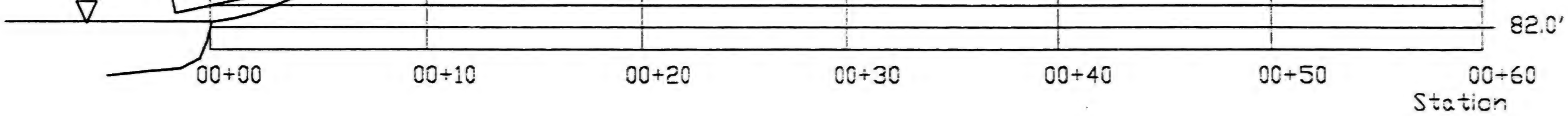
Designed by: LB	Date: 8/7/99	Drawn by: RR/LB	Date: 8/7/99
Sheet No.: 1a	of: 12	Drawing No.: Y-98-3	



WATER SURFACE ELEVATION
82.2' 5/28/99

GROUND PROFILE



WATER SURFACE ELEVATION
82.2' 5/28/99

1.5' POOL DEPTH

GROUND PROFILE
LOOKING DOWNSTREAM
NTS

AT NEW LOCATION DS OF BRIDGE

NOTES
1. Bypass Invert Elev. Inside structure= 88.00'
2. The Bypass Pipeline shall have no more than 20% uniform grade to the outlet.
3. Bypass pipe location and alignment is approximate, the exact location and alignment will be determined by the Engineer in the field.

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BYPASS PIPELINE
MACGOWAN DITCH

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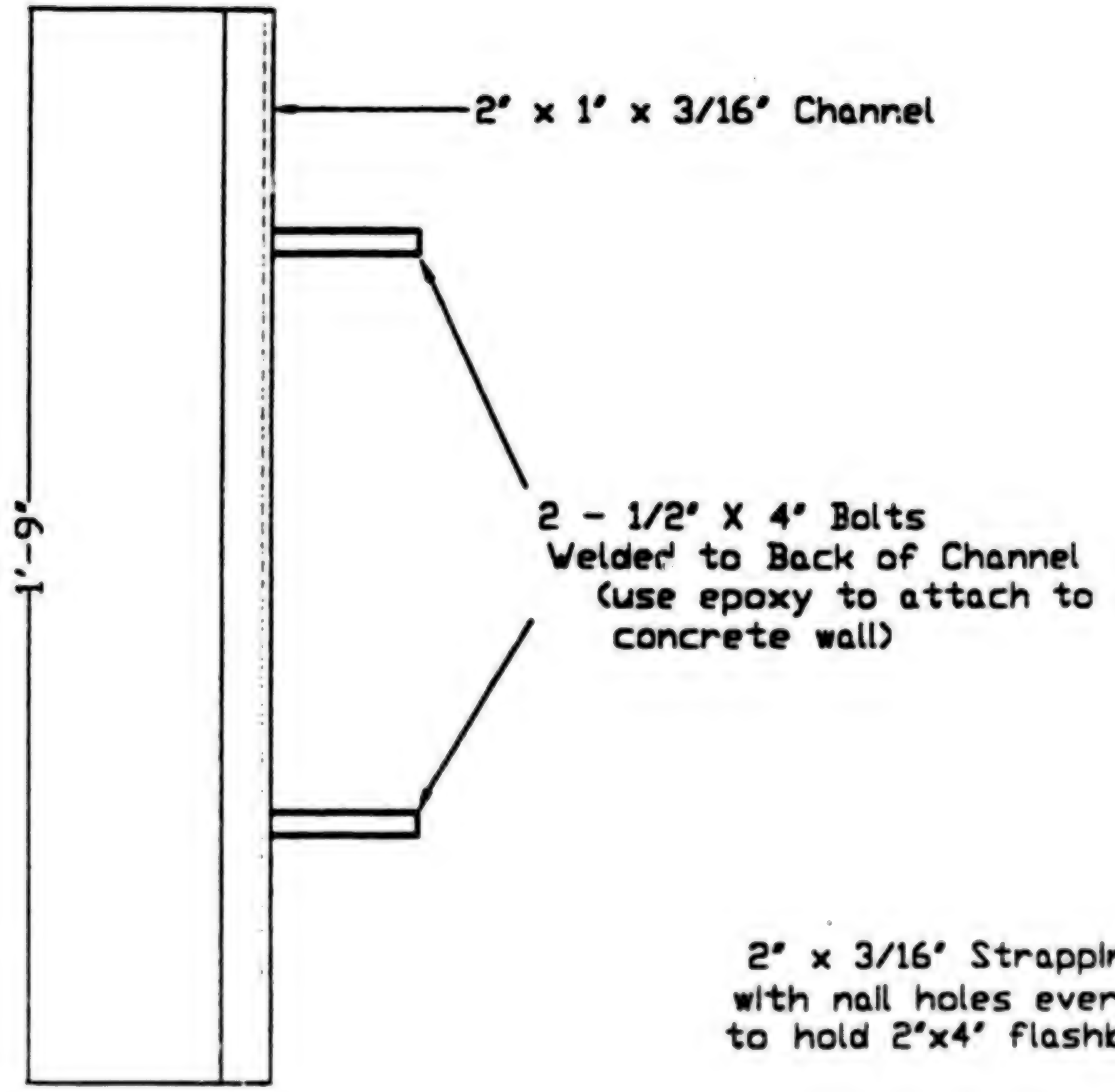
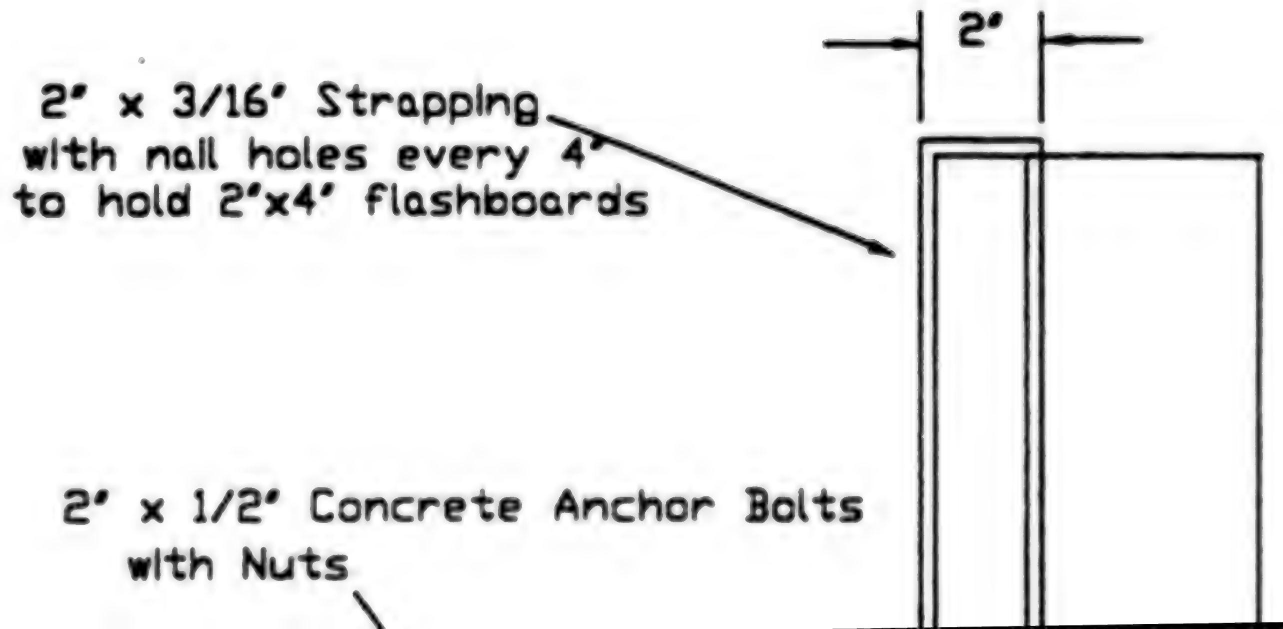
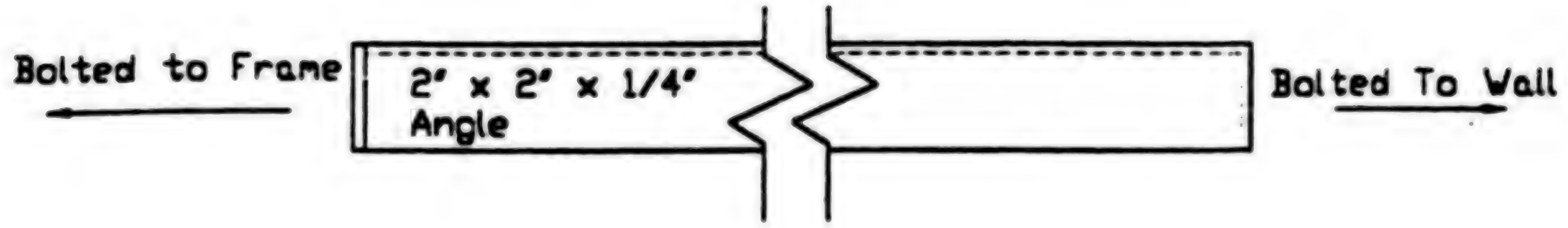
Sheet No.: 2a	of: 12	Drawing No.: Y-98-3	2

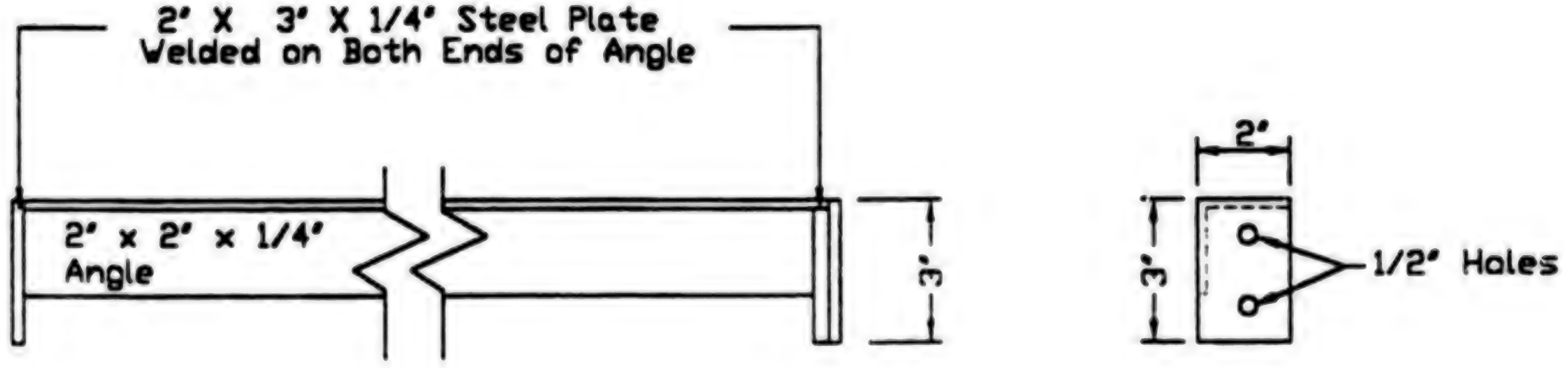

2" x 1" x 3/16" Channel
2 - 1/2" X 4" Bolts Welded to Back of Channel (use epoxy to attach to concrete wall)
1'-9"

SIDE VIEW
SLOT TYPE 1


2"
2" x 3/16" Strapping with nail holes every 4" to hold 2"x4" flashboards
2" x 1/2" Concrete Anchor Bolts with Nuts



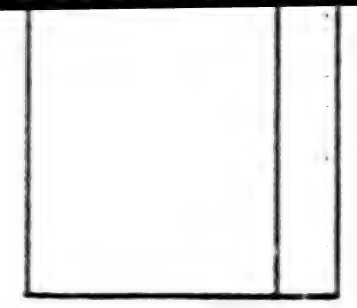
TOP VIEW



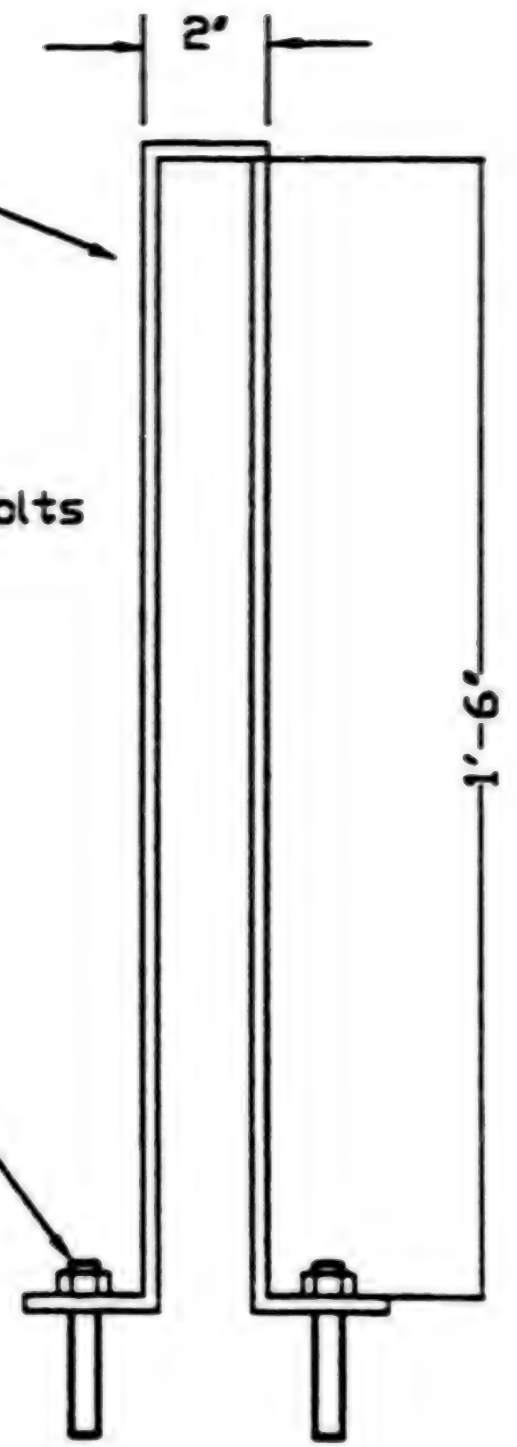
FRONT VIEW

END VIEW

HORIZONTAL FRAME SUPPORT
SCALE: 1" = 1/2'



SIDE VIEW
SLOT TYPE 1


2"
2" x 3/16' Strapping with nail holes every 4" to hold 2"x4' flashboards
2" x 1/2" Concrete Anchor Bolts with Nuts
1'-6"

FRONT VIEW
SLOT TYPE 2

FLASHBOARD SLOTS

SCALE: 1" = 1/2'

FRONT VIEW

END VIEW

HORIZONTAL FRAME SUPPORT

SCALE: 1" = 1/2'

ATTACHMENT DETAILS

MACGOWAN DITCH

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

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Sheet No.: 5	of: 12	Drawing No.:	

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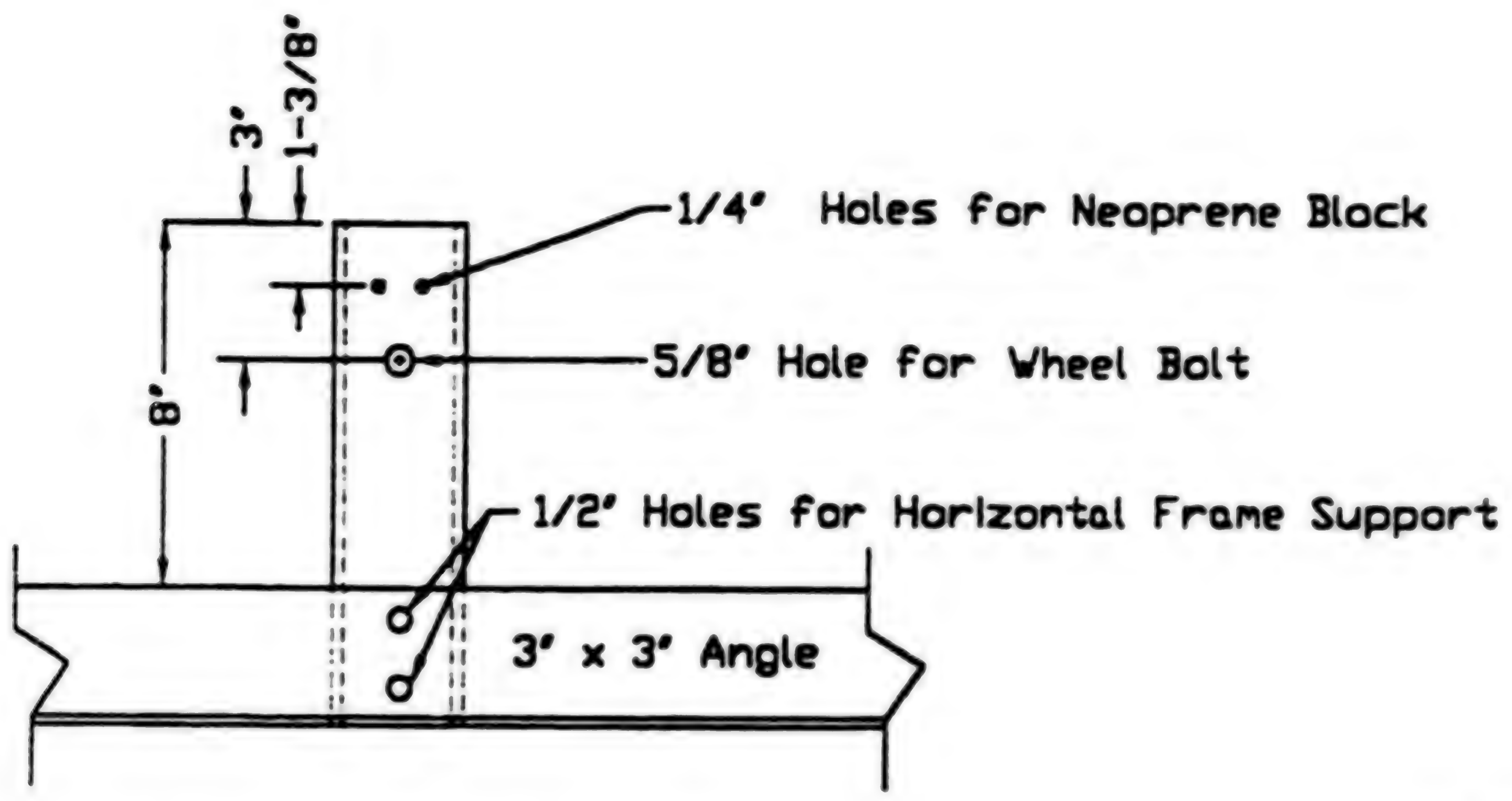
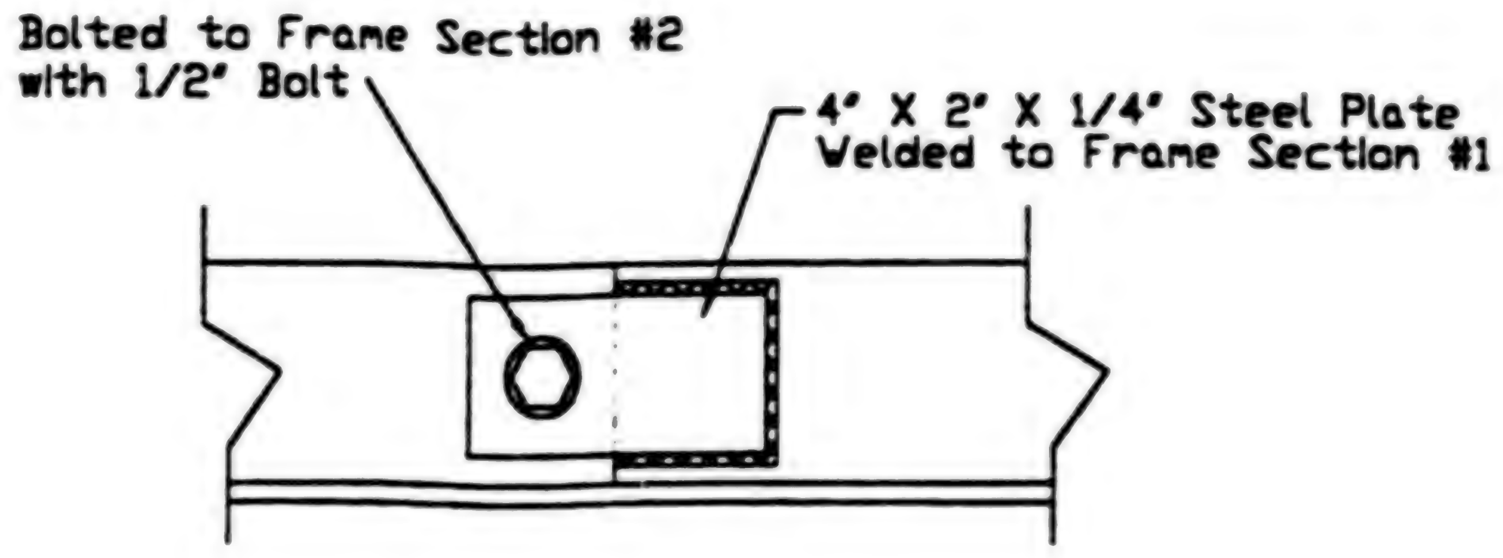
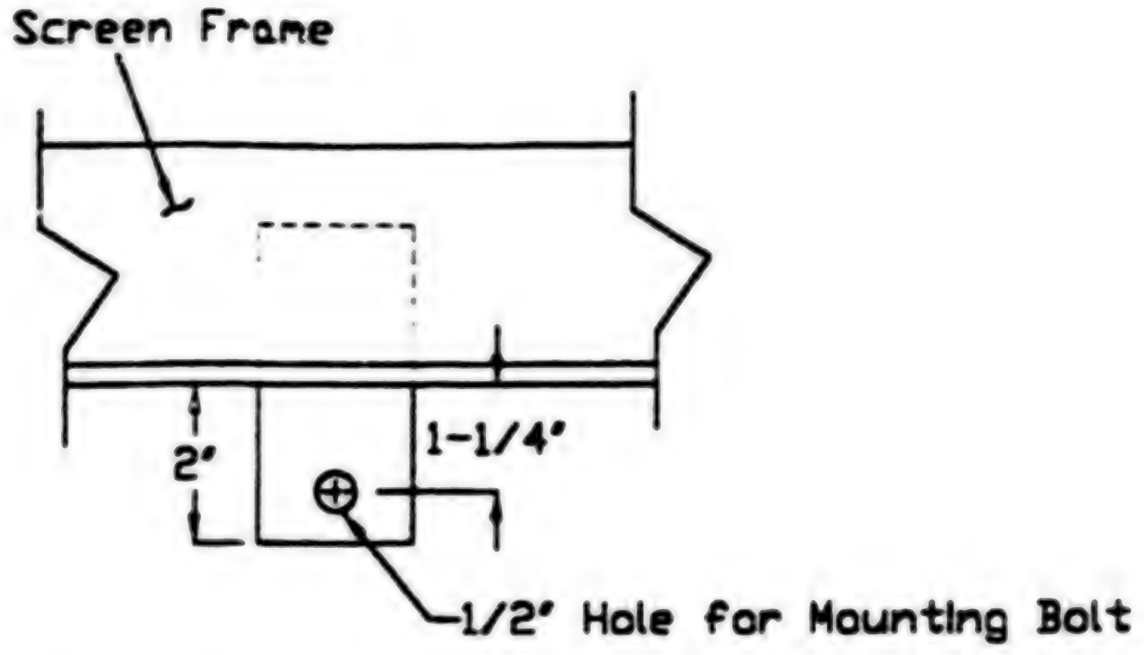

3"
1-3/8"
1/4" Holes for Neoprene Block
5/8" Hole for Wheel Bolt
8"
1/2" Holes for Horizontal Frame Support
3" x 3" Angle

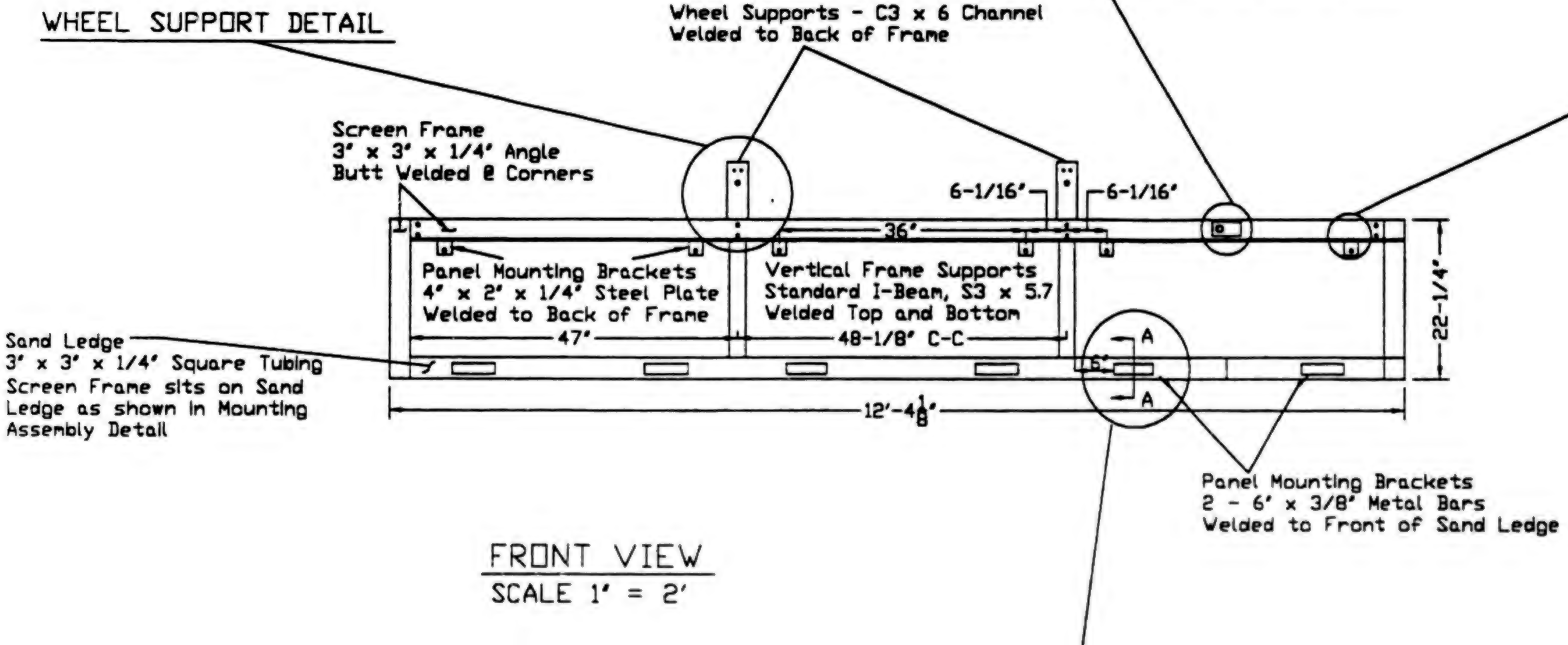
WHEEL SUPPORT DETAIL


Bolted to Frame Section #2
with 1/2" Bolt
4" X 2" X 1/4" Steel Plate
Welded to Frame Section #1

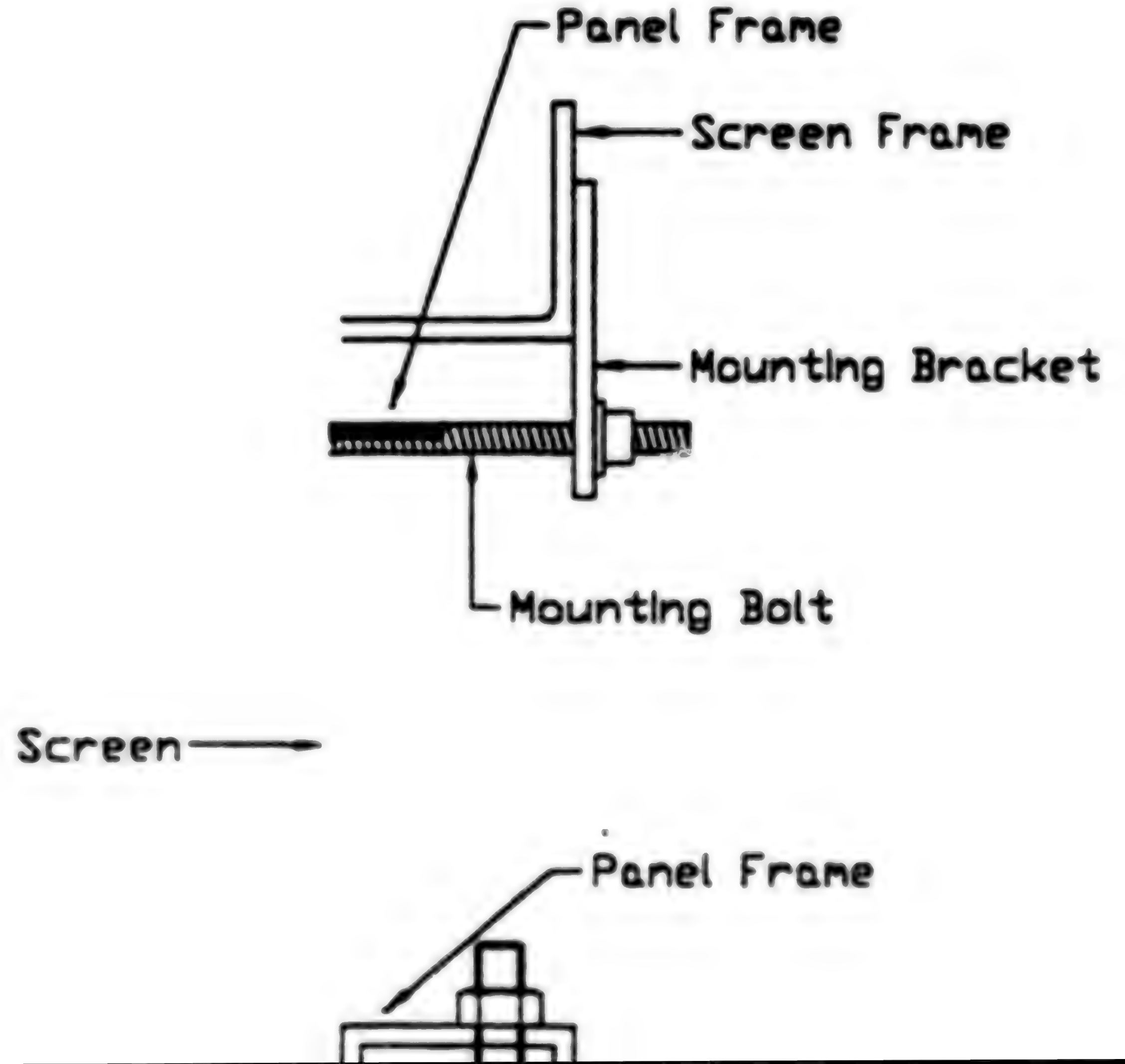
CONSTRUCTION JOINT DETAIL

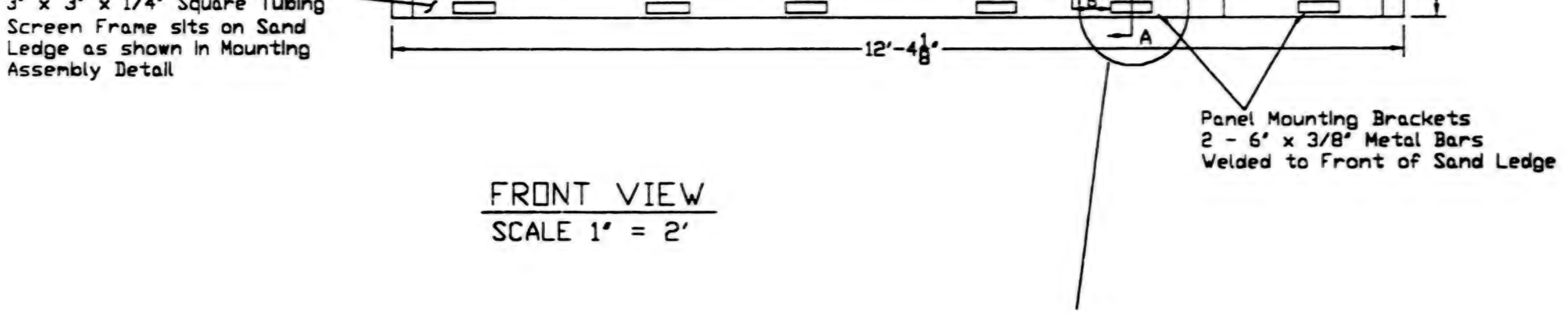


MOUNTING BRACKET DETAIL



FRONT VIEW
SCALE 1" = 2'



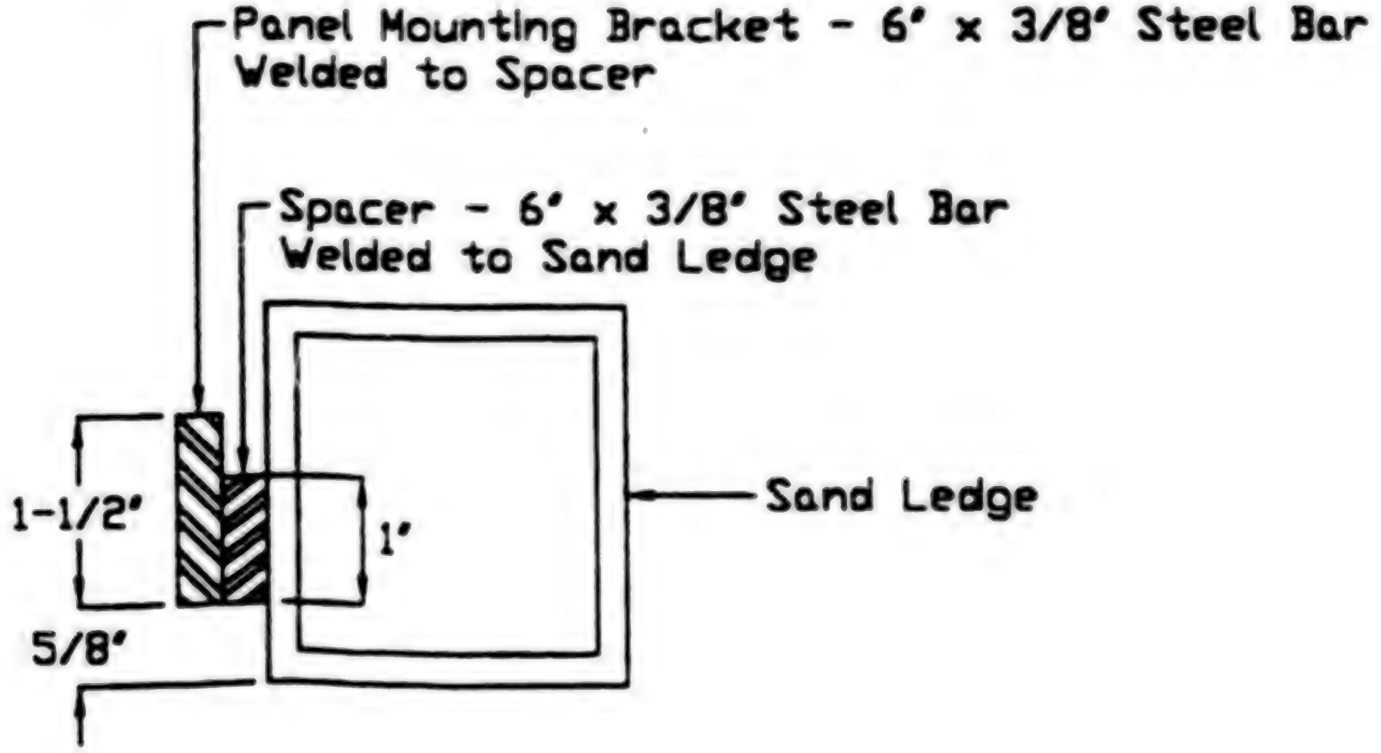

3" x 3" x 1/4" Square Tubing
Screen Frame sits on Sand Ledge as shown in Mounting Assembly Detail
12'-4⅛"
A
Panel Mounting Brackets
2 - 6" x 3/8" Metal Bars
Welded to Front of Sand Ledge

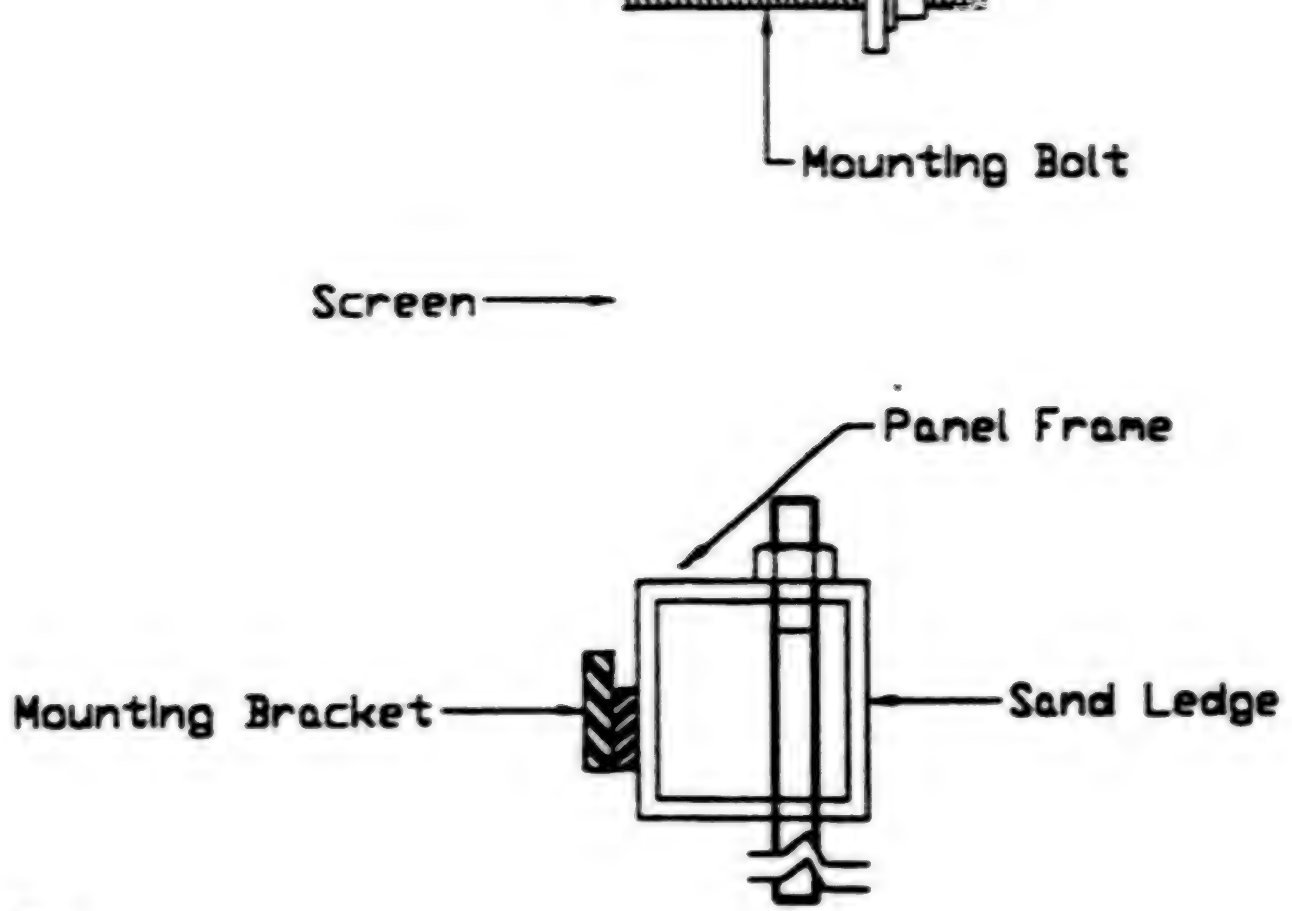
FRONT VIEW

SCALE 1" = 2'

SECTION A-A

SCALE: 1" = 3"


Panel Mounting Bracket - 6" x 3/8" Steel Bar
Welded to Spacer
Spacer - 6" x 3/8" Steel Bar
Welded to Sand Ledge
1-1/2"
1"
5/8"
Sand Ledge



MOUNTING ASSEMBLY DETAIL

NTS

NOTES
1. Frame may be constructed in sections to be assembled on-site
2. All welds shall be full depth fillet welds or as directed by the Engineer
3. The Screen Frame shall be made table flat and symetrical about the center

SCREEN FRAME

MACGOWAN DITCH

U.S. DEPARTMENT OF AGRICULTURE
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Sheet No.: 6	of: 12	Drawing No.:	

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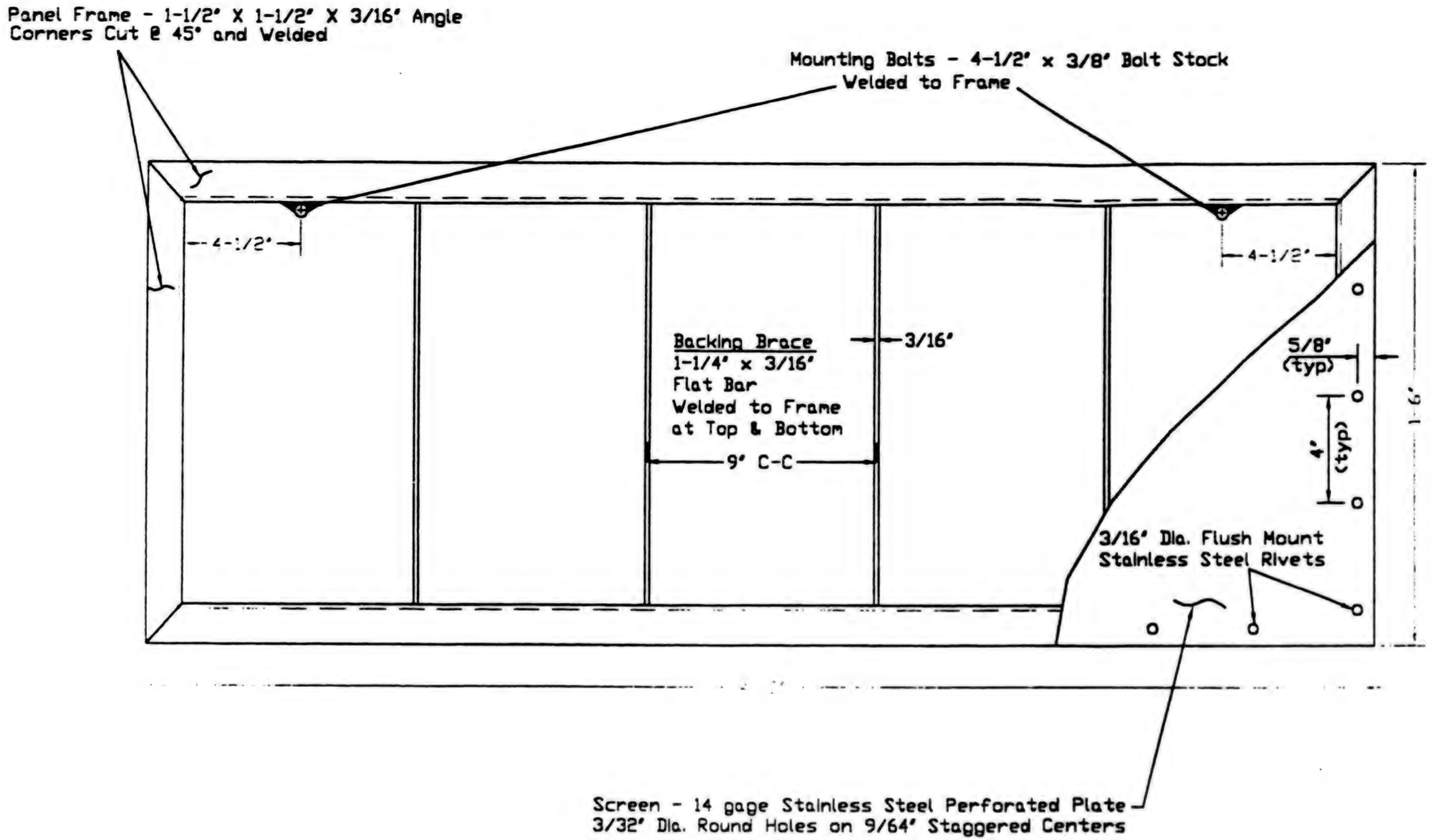
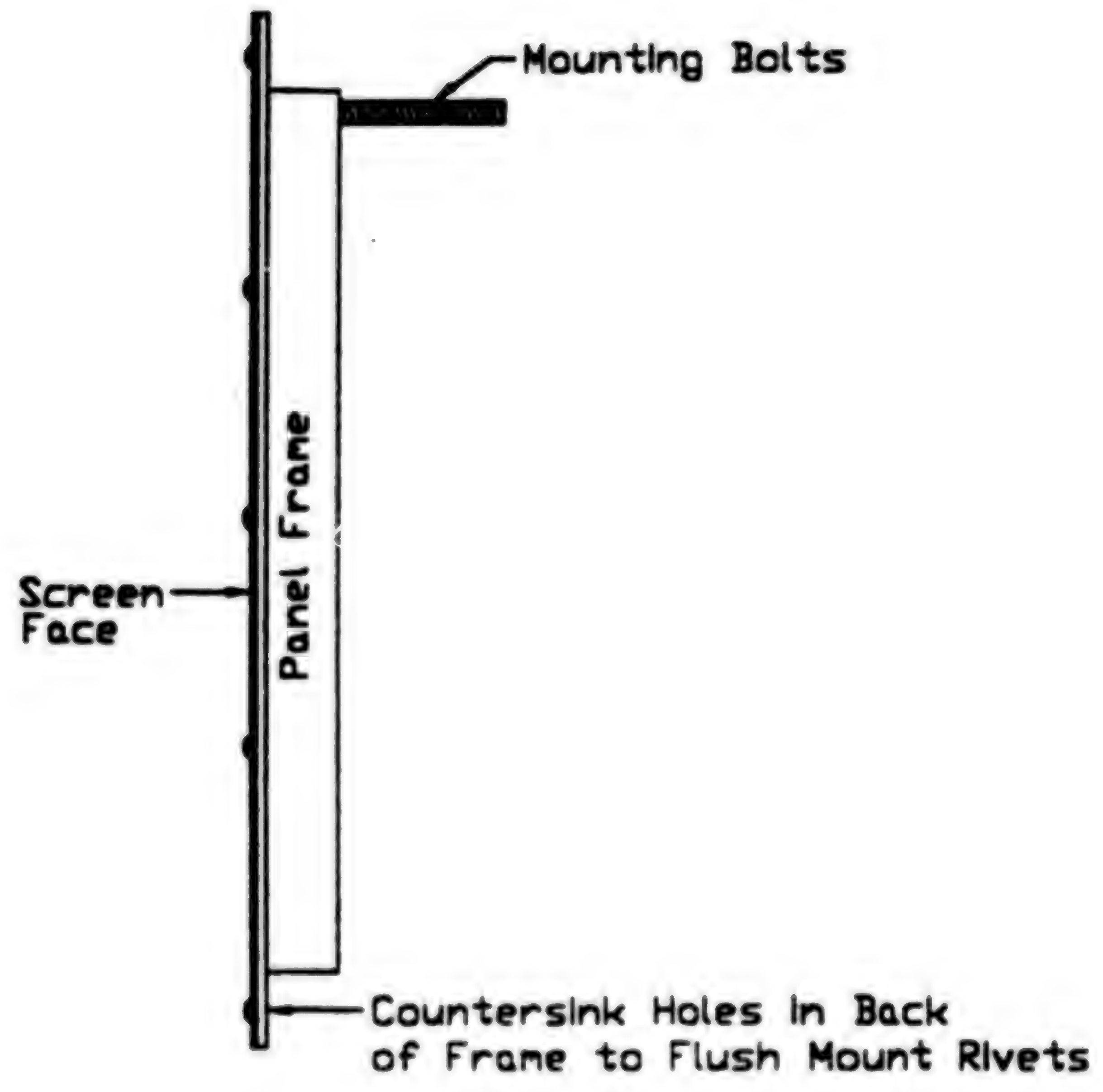

Panel Frame - 1-1/2" X 1-1/2" X 3/16" Angle
Corners Cut @ 45° and Welded
Mounting Bolts - 4-1/2" x 3/8" Bolt Stock
Welded to Frame
4-1/2"
4-1/2"
Backing Brace
1-1/4" x 3/16"
Flat Bar
Welded to Frame
at Top & Bottom
3/16"
9" C-C
5/8"
(typ)
4"
(typ)
1'-6"
3/16" Dia. Flush Mount
Stainless Steel Rivets
Screen - 14 gage Stainless Steel Perforated Plate
3/32" Dia. Round Holes on 9/64" Staggered Centers



SIDE VIEW
SCALE: 1" = 1/2'

FRONT VIEW

Screen - 14 gage Stainless Steel Perforated Plate
3/32" Dia. Round Holes on 9/64" Staggered Centers

SIDE VIEW

SCALE: 1" = 1/2'

FRONT VIEW

SCALE: 1" = 1/2'

NOTES
1. Panel frame and screen plate shall be table flat.
2. All welds shall be full depth fillet welds or as directed by Engineer
3. Use 3 - 4' X 1.5' Screen Panels for total screen width

SCREEN PANELS
MACGOWAN DITCH

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

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Sheet No.: 7	of: 12	Drawing No.:	

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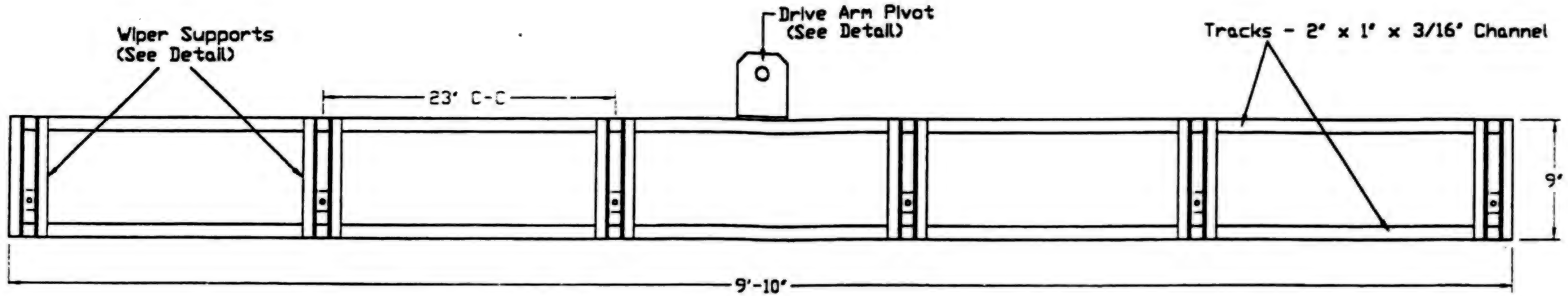
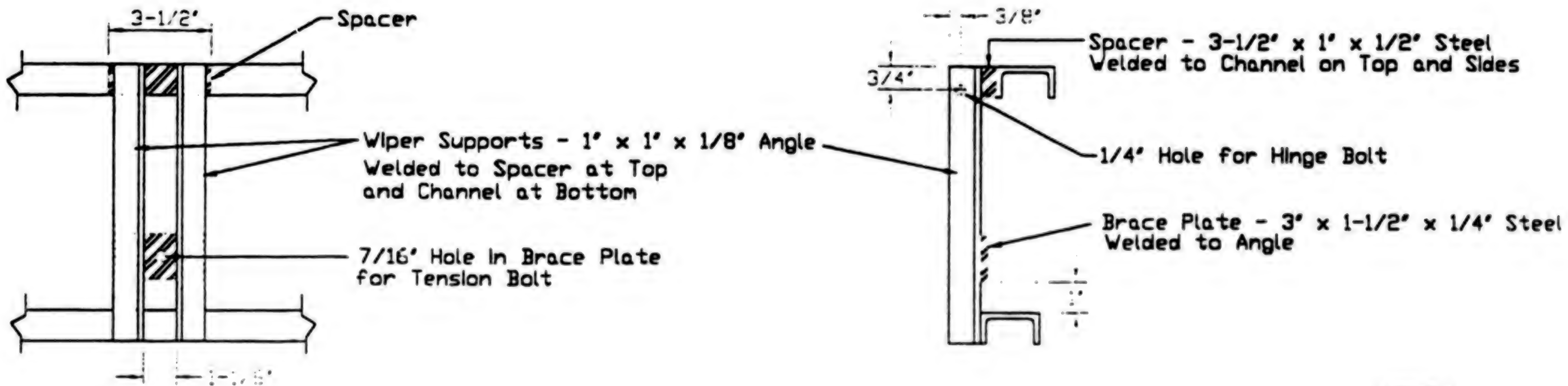


FRONT VIEW
SCALE: 1" = 1'


3-1/2"
Spacer
Wiper Supports - 1" x 1" x 1/8" Angle
Welded to Spacer at Top
and Channel at Bottom
7/16" Hole In Brace Plate
for Tension Bolt
1-1/8"
3/8"
3/4"
Spacer - 3-1/2" x 1" x 1/2" Steel
Welded to Channel on Top and Sides
1/4" Hole for Hinge Bolt
Brace Plate - 3" x 1-1/2" x 1/4" Steel
Welded to Angle

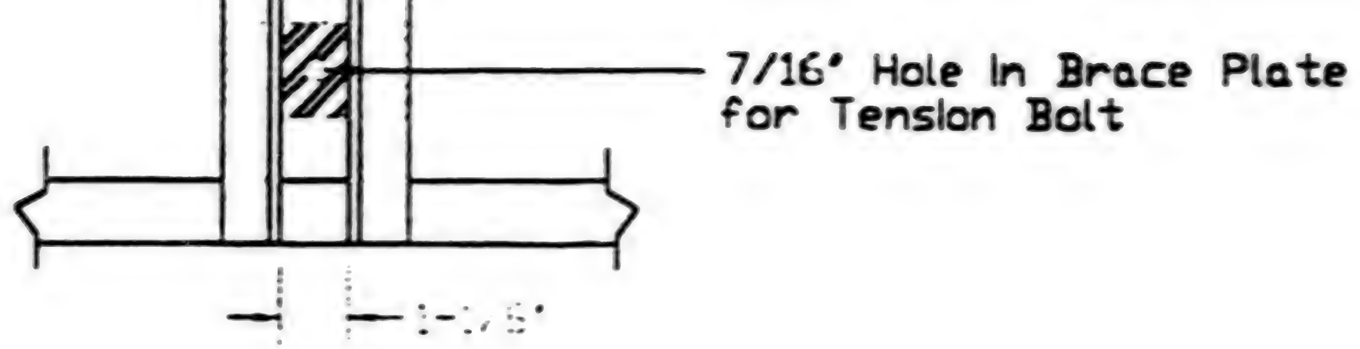
FRONT VIEW

SIDE VIEW

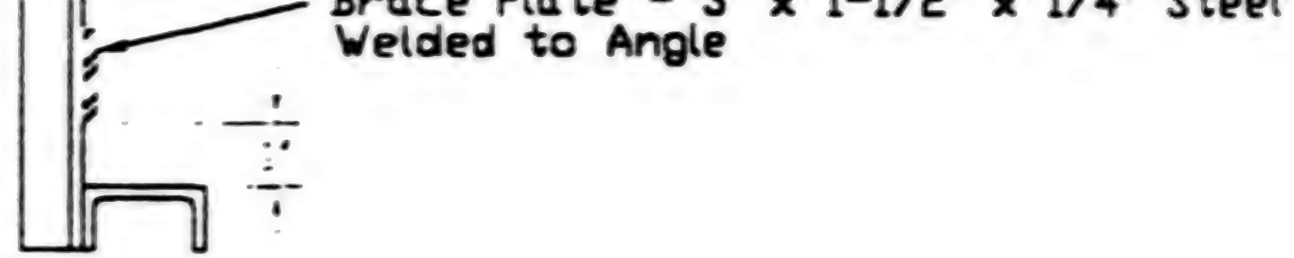
WIPER SUPPORT

NOTES

1. Pivot Arm dimensions may vary depending on bearing assembly dimensions
2. The Track Assembly shall be made table flat and symetrical about the center
3. All welds shall be full depth fillet welds or as directed by the Engineer



FRONT VIEW

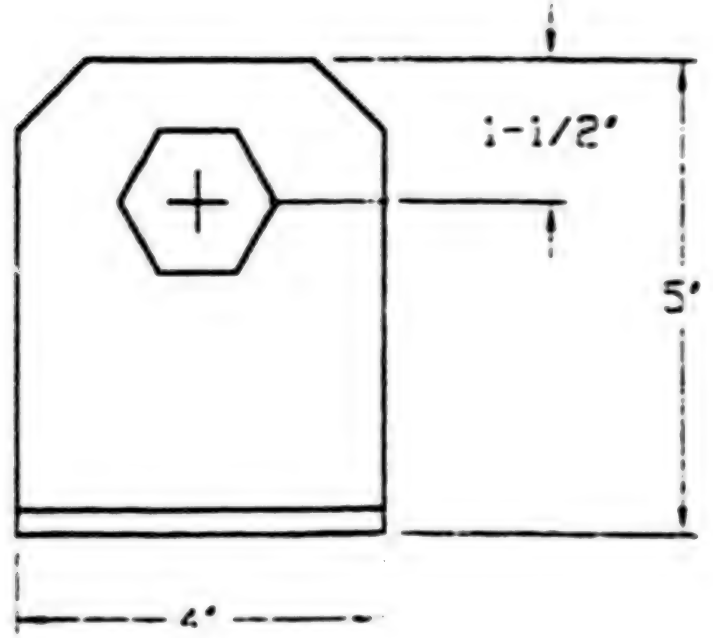


SIDE VIEW

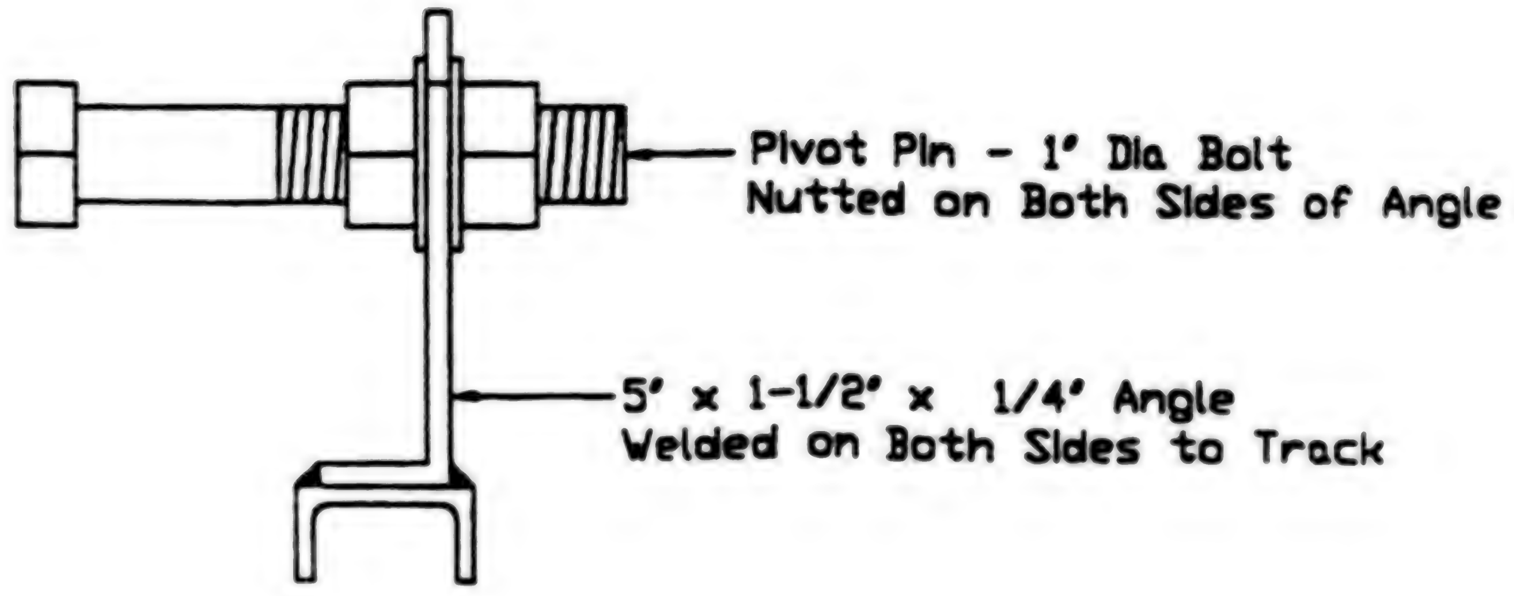
WIPER SUPPORT
SCALE: 1" = 6"

NOTES

1. Pivot Arm dimensions may vary depending on bearing assembly dimensions
2. The Track Assembly shall be made table flat and symetrical about the center
3. All welds shall be full depth fillet welds or as directed by the Engineer



FRONT VIEW


Pivot Pin - 1" Dia Bolt Nutted on Both Sides of Angle
5" x 1-1/2" x 1/4" Angle Welded on Both Sides to Track

SIDE VIEW

DRIVE ARM PIVOT
1" = 4"

TRACK ASSEMBLY
MACGOWAN DITCH

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

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Sheet No.: 8	of: 12	Drawing No.:	

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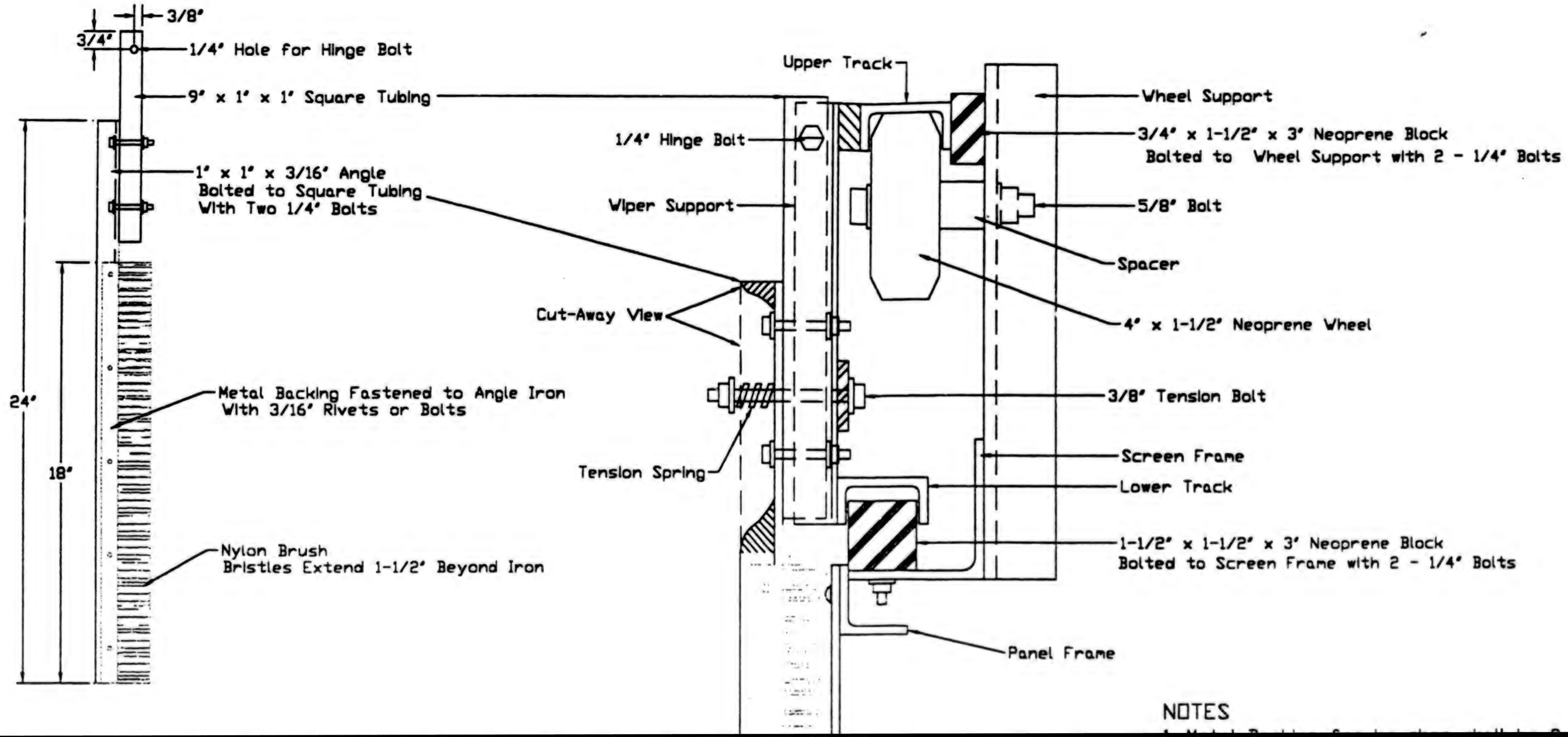
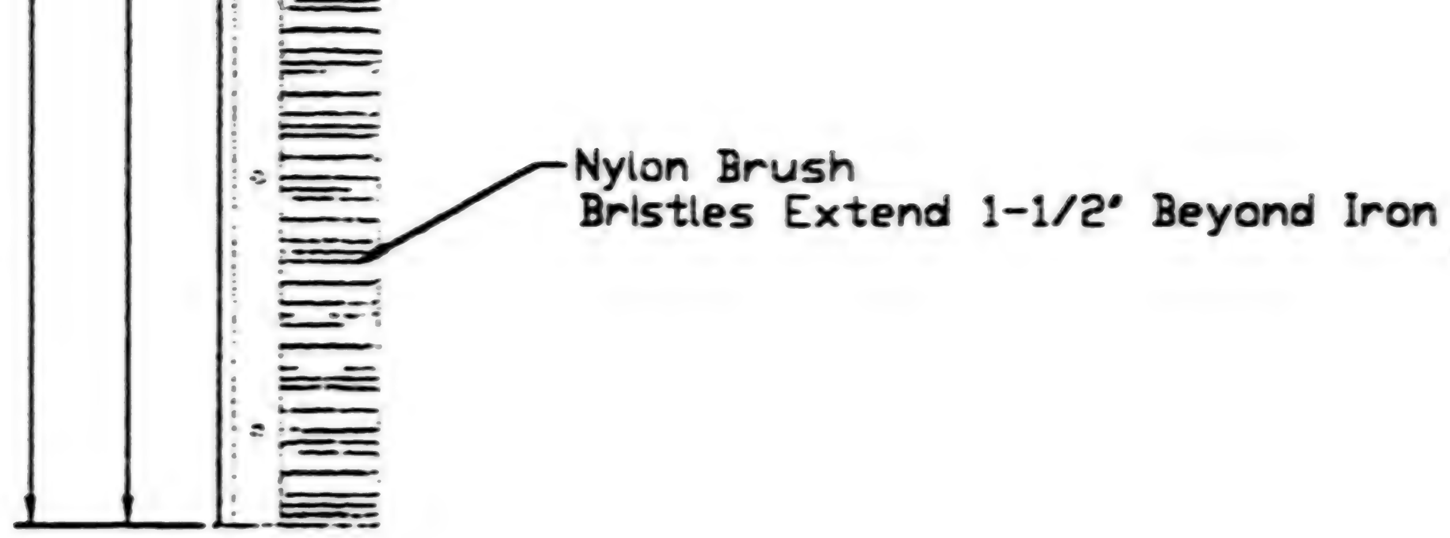
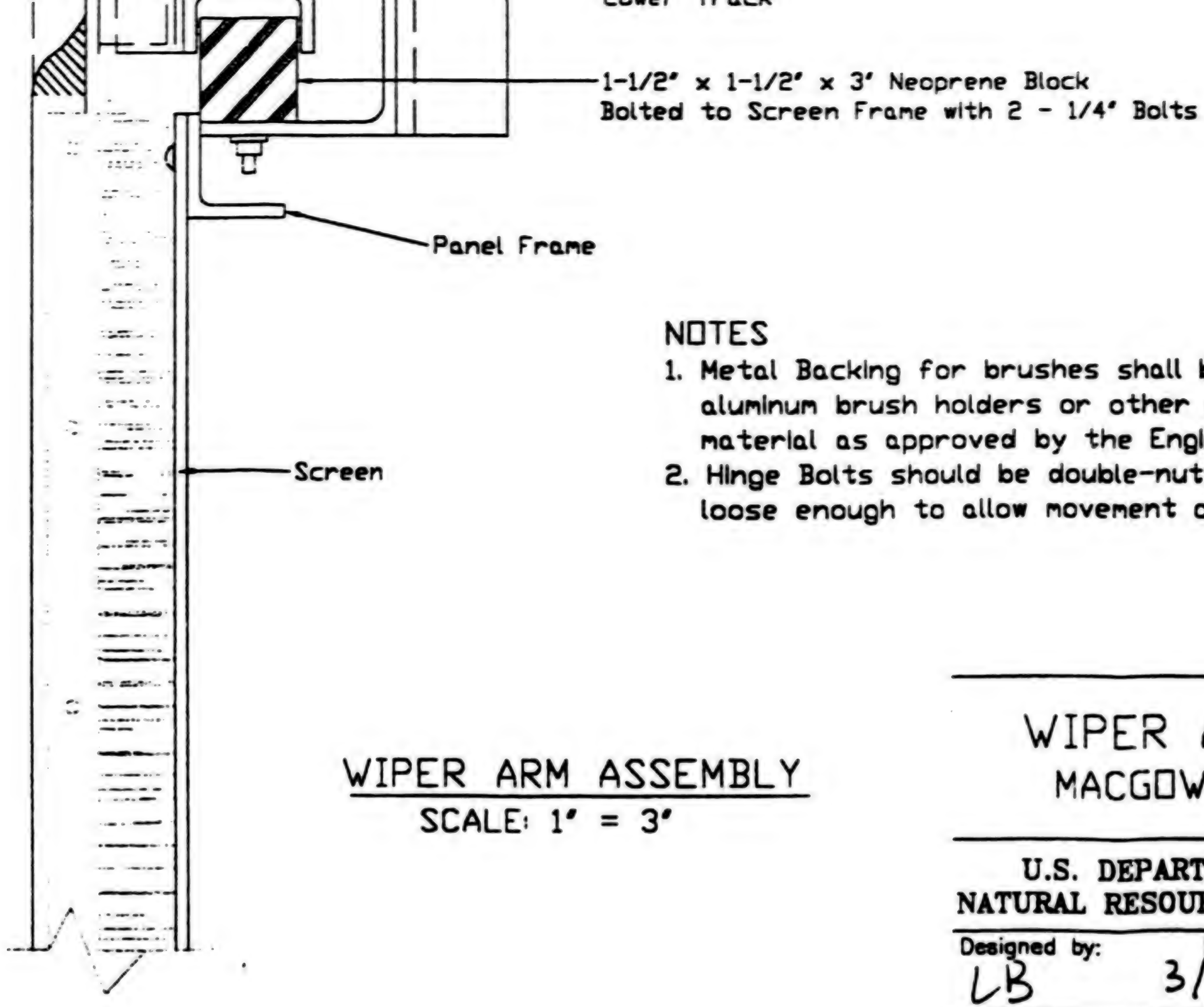

3/8"
3/4"
1/4" Hole for Hinge Bolt
9" x 1" x 1" Square Tubing
1" x 1" x 3/16" Angle
Bolted to Square Tubing
With Two 1/4" Bolts
24"
18"
Metal Backing Fastened to Angle Iron
With 3/16" Rivets or Bolts
Nylon Brush
Bristles Extend 1-1/2" Beyond Iron
Upper Track
1/4" Hinge Bolt
Wiper Support
Cut-Away View
Tension Spring
Wheel Support
3/4" x 1-1/2" x 3" Neoprene Block
Bolted to Wheel Support with 2 - 1/4" Bolts
5/8" Bolt
Spacer
4" x 1-1/2" Neoprene Wheel
3/8" Tension Bolt
Screen Frame
Lower Track
1-1/2" x 1-1/2" x 3" Neoprene Block
Bolted to Screen Frame with 2 - 1/4" Bolts
Panel Frame

NOTES



WIPER ARM

SCALE: 1" = 6'


1-1/2" x 1-1/2" x 3" Neoprene Block
Bolted to Screen Frame with 2 - 1/4" Bolts
Panel Frame
Screen

NOTES

1. Metal Backing for brushes shall be 2-piece aluminum brush holders or other appropriate material as approved by the Engineer.
2. Hinge Bolts should be double-nutted and remain loose enough to allow movement of brush arm

WIPER ARM ASSEMBLY

SCALE: 1" = 3'

WIPER ARM ASSEMBLY

MACGOWAN DITCH

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

Designed by: LB	Date: 3/1/99	Drawn by: RR/LB	Date: 3/1/99
Sheet No.: 9	of: 12	Drawing No.:	

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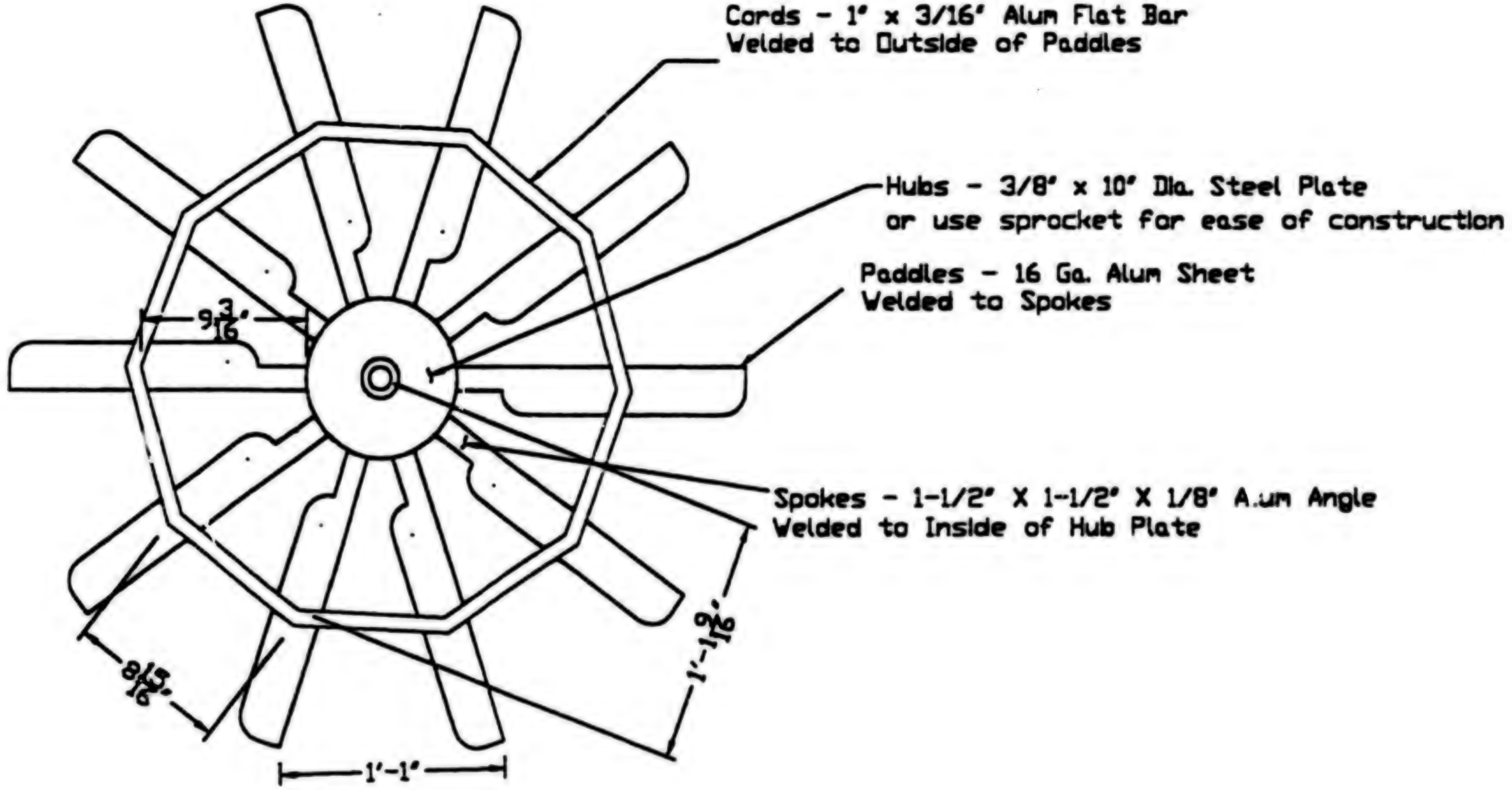
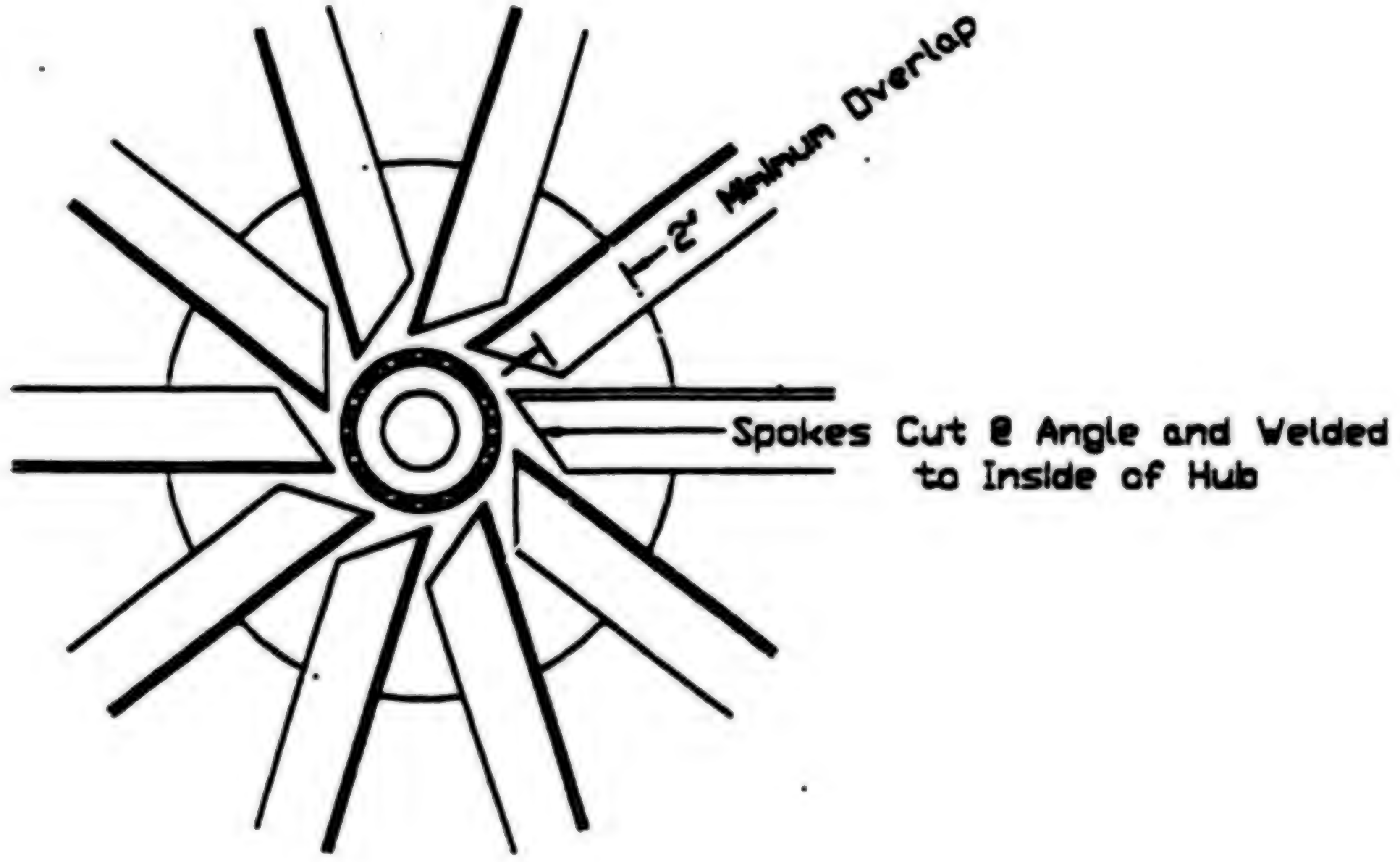

Cords - 1" x 3/16" Alum Flat Bar
Welded to Outside of Paddles
Hubs - 3/8" x 10" Dia. Steel Plate
or use sprocket for ease of construction
Paddles - 16 Ga. Alum Sheet
Welded to Spokes
Spokes - 1-1/2" X 1-1/2" X 1/8" Alum Angle
Welded to Inside of Hub Plate
9 3/16"
8 15/16"
1'-1"
1'-1 9/16"

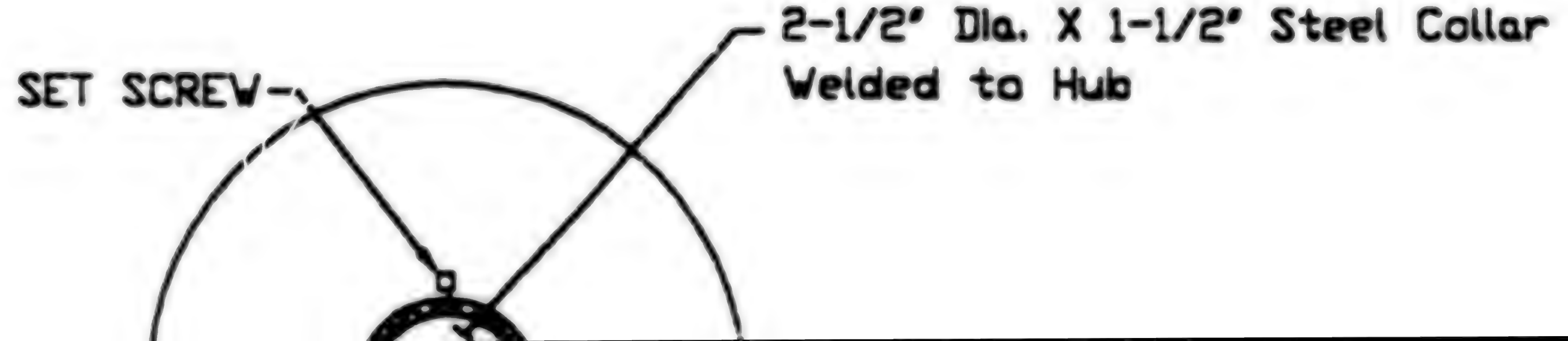
Side View

SCALE 1" = 1'



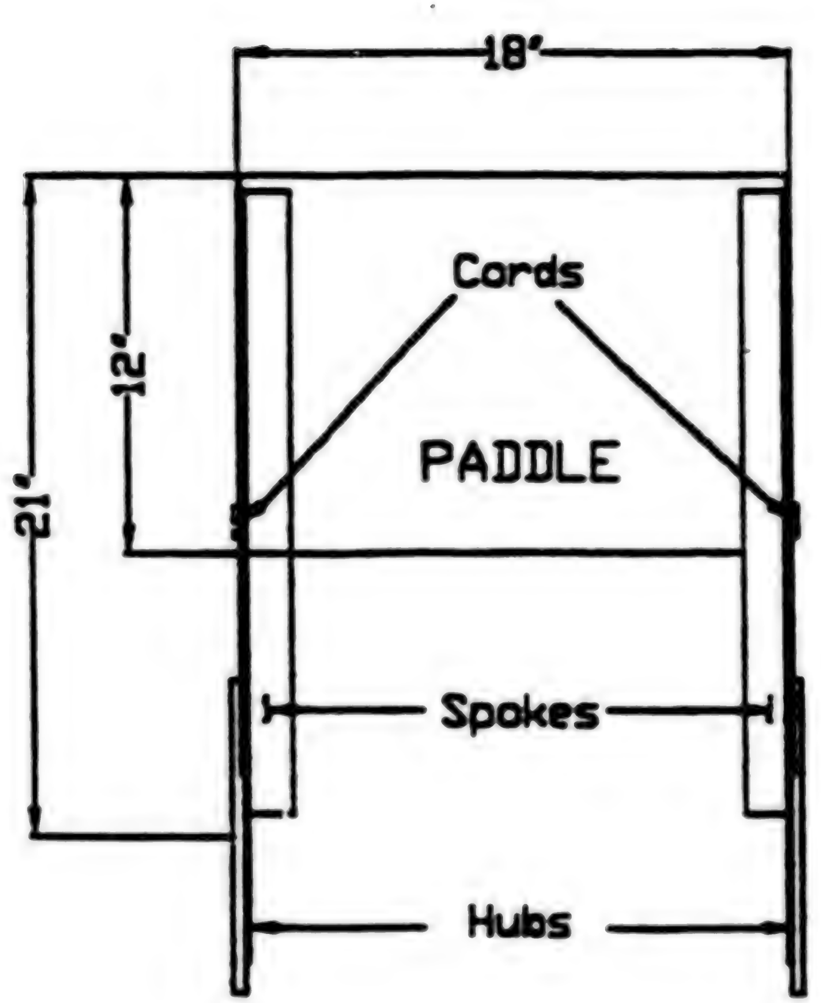
Spoke Detail

SCALE 1" = 6"



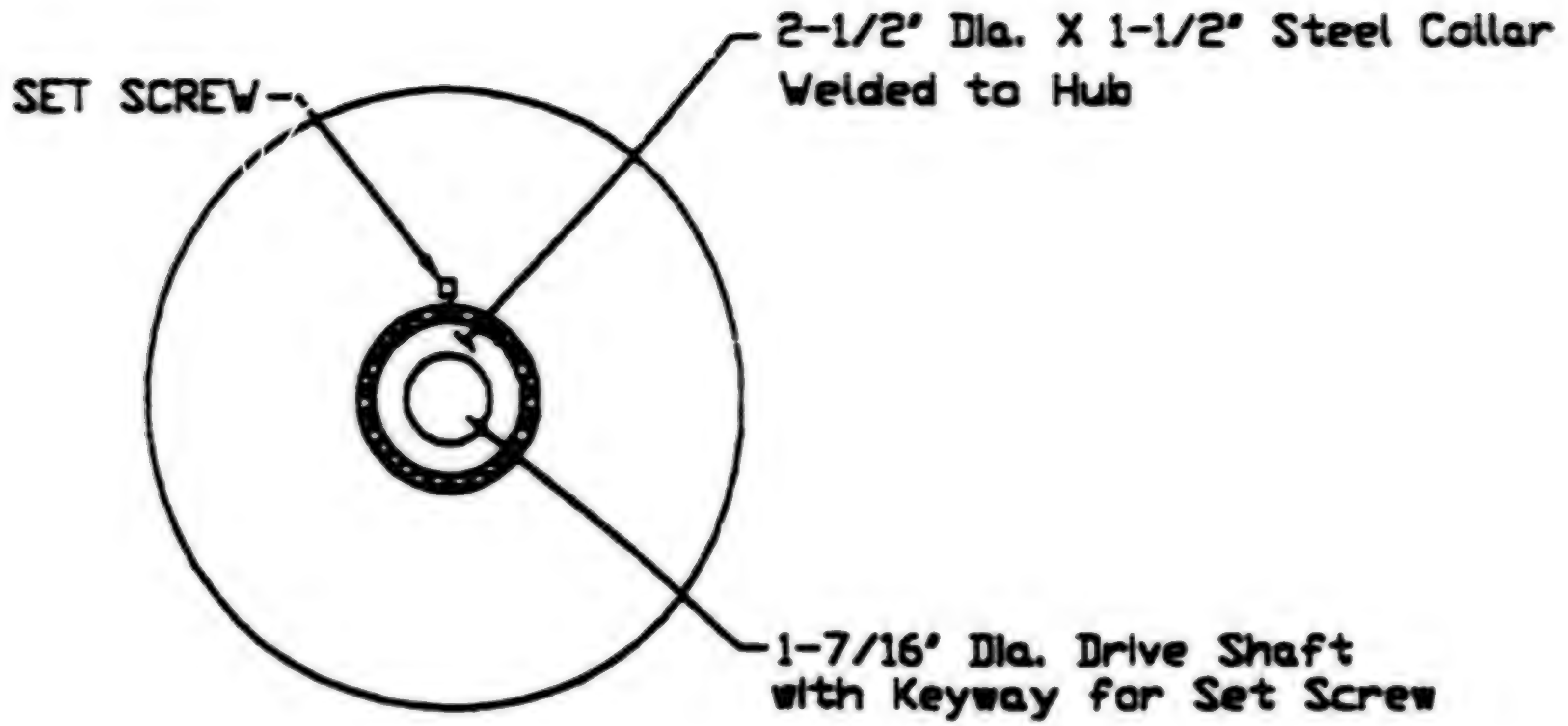
Side View

SCALE 1" = 1'



Paddle Arm

SCALE 1" = 1'


SET SCREW
2-1/2" Dia. X 1-1/2" Steel Collar Welded to Hub
1-7/16" Dia. Drive Shaft with Keyway for Set Screw

Hub Detail

SCALE 1" = 6'

PADDLE WHEEL ASSEMBLY
MACGOWAN DITCH

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

Designed by: LB	Date: 8/7/99	Drawn by: RR/LB	Date: 8/7/99
Sheet No.: 10a	of: 12	Drawing No.: Y-98-3	

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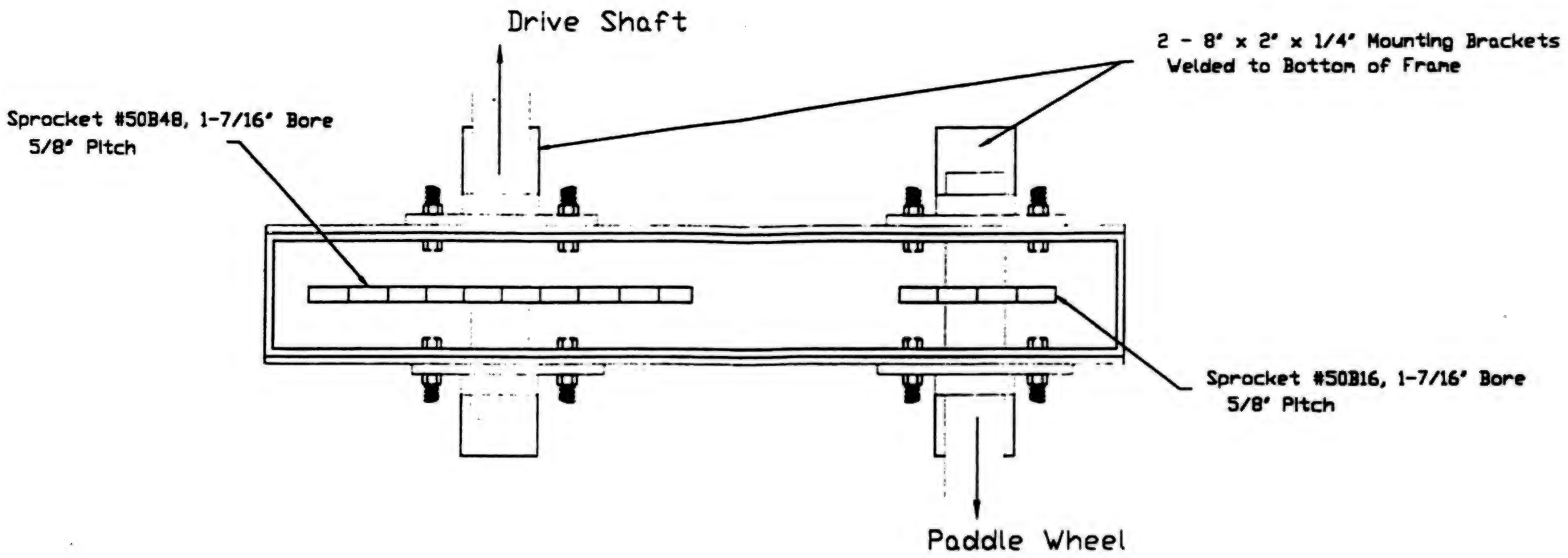
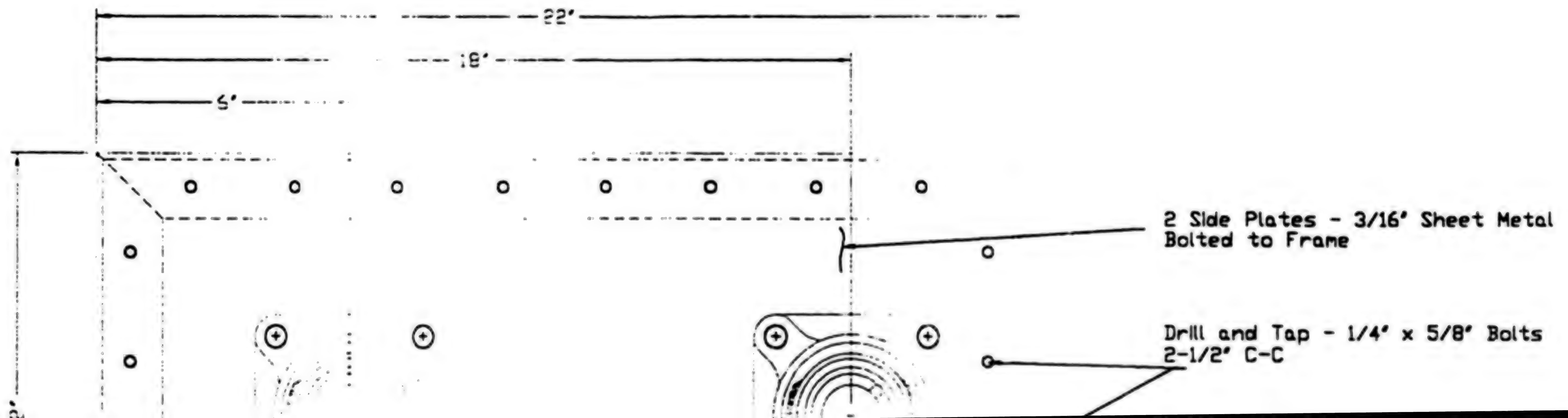
TOP VIEW
SCALE 1' = 4'

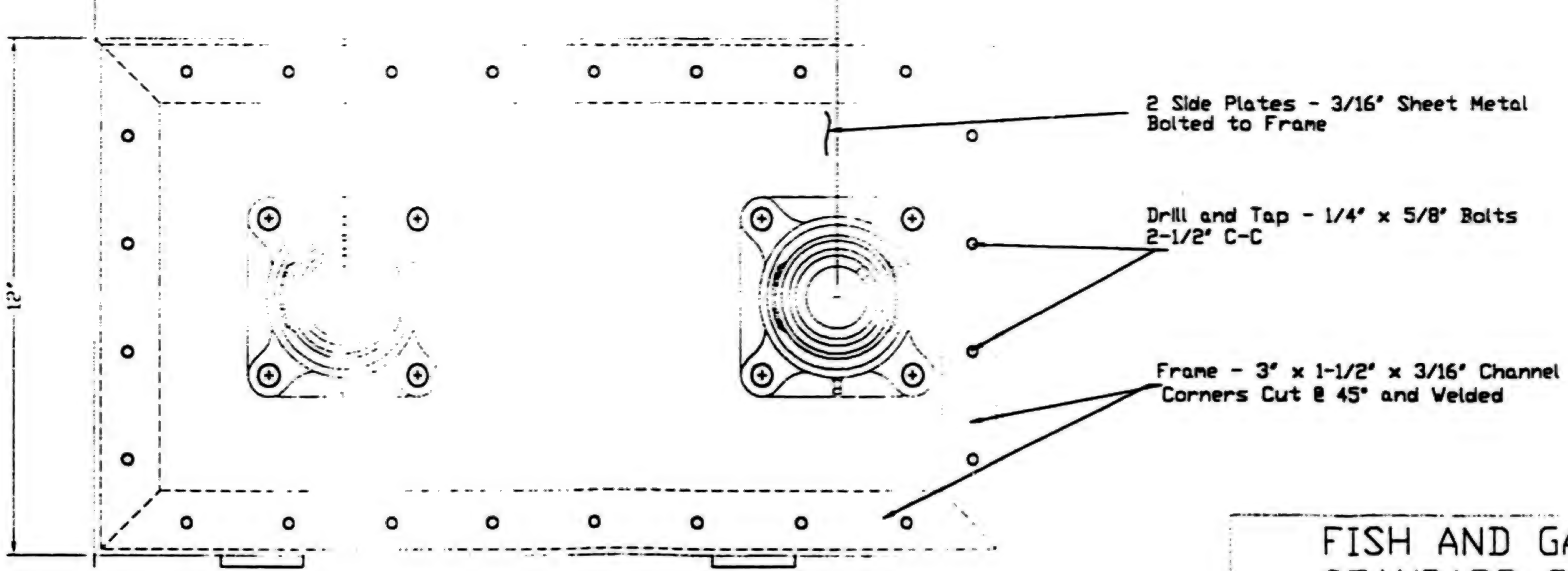

Drive Shaft
2 - 8' x 2' x 1/4' Mounting Brackets
Welded to Bottom of Frame
Sprocket #50B48, 1-7/16' Bore
5/8' Pitch
Sprocket #50B16, 1-7/16' Bore
5/8' Pitch
Paddle Wheel

FRONT VIEW
SCALE 1' = 4'


22'
18'
6'
2 Side Plates - 3/16' Sheet Metal
Bolted to Frame
Drill and Tap - 1/4' x 5/8' Bolts
2-1/2' C-C

FRONT VIEW

SCALE 1' = 4'


12"
2 Side Plates - 3/16' Sheet Metal Bolted to Frame
Drill and Tap - 1/4' x 5/8' Bolts 2-1/2' C-C
Frame - 3' x 1-1/2' x 3/16' Channel Corners Cut @ 45° and Welded

NOTES
1. Bearing Dodge #124208 - 1-7/16' ID
2. All welds shall be full depth fillet welds or as directed by Engineer
3. Gear ratio is 1:3

FISH AND GAME
STANDARD GEAR BOX
MACGOWAN DITCH

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Sheet No.: 11	**of:** 12	**Drawing No.:**	

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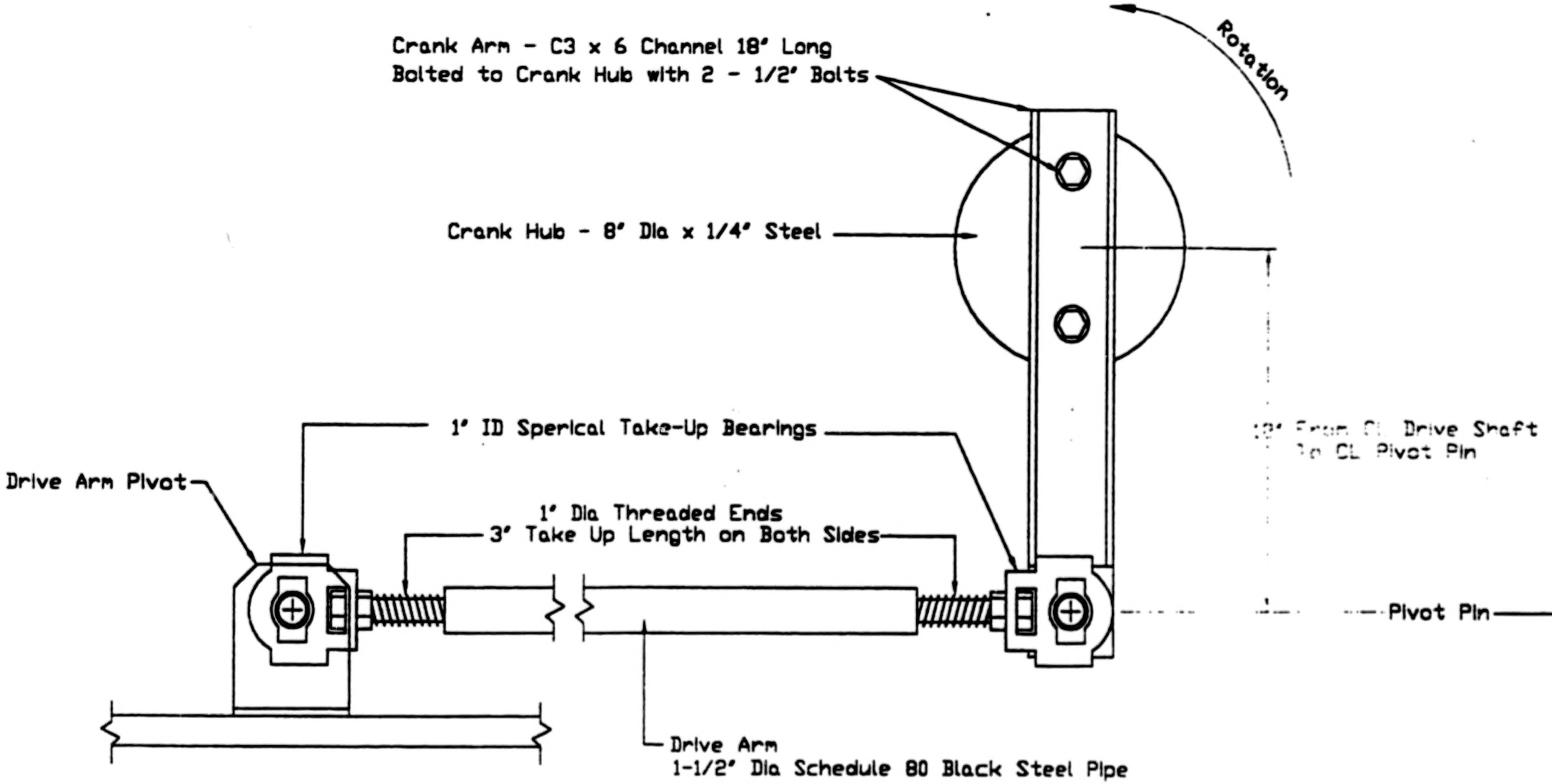
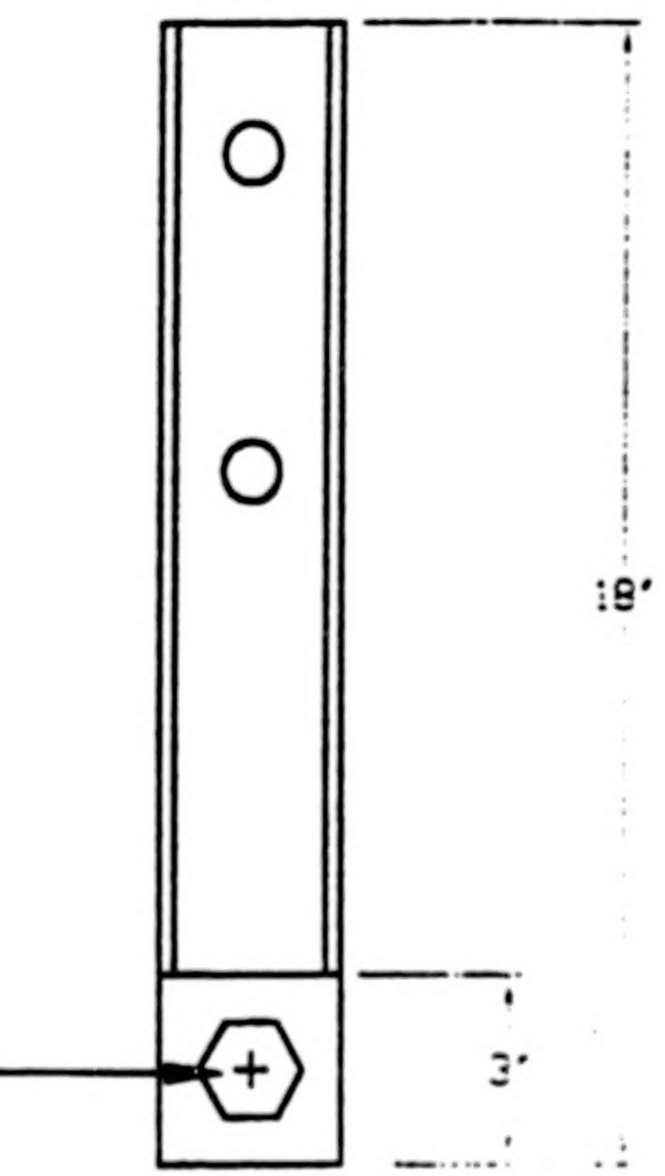
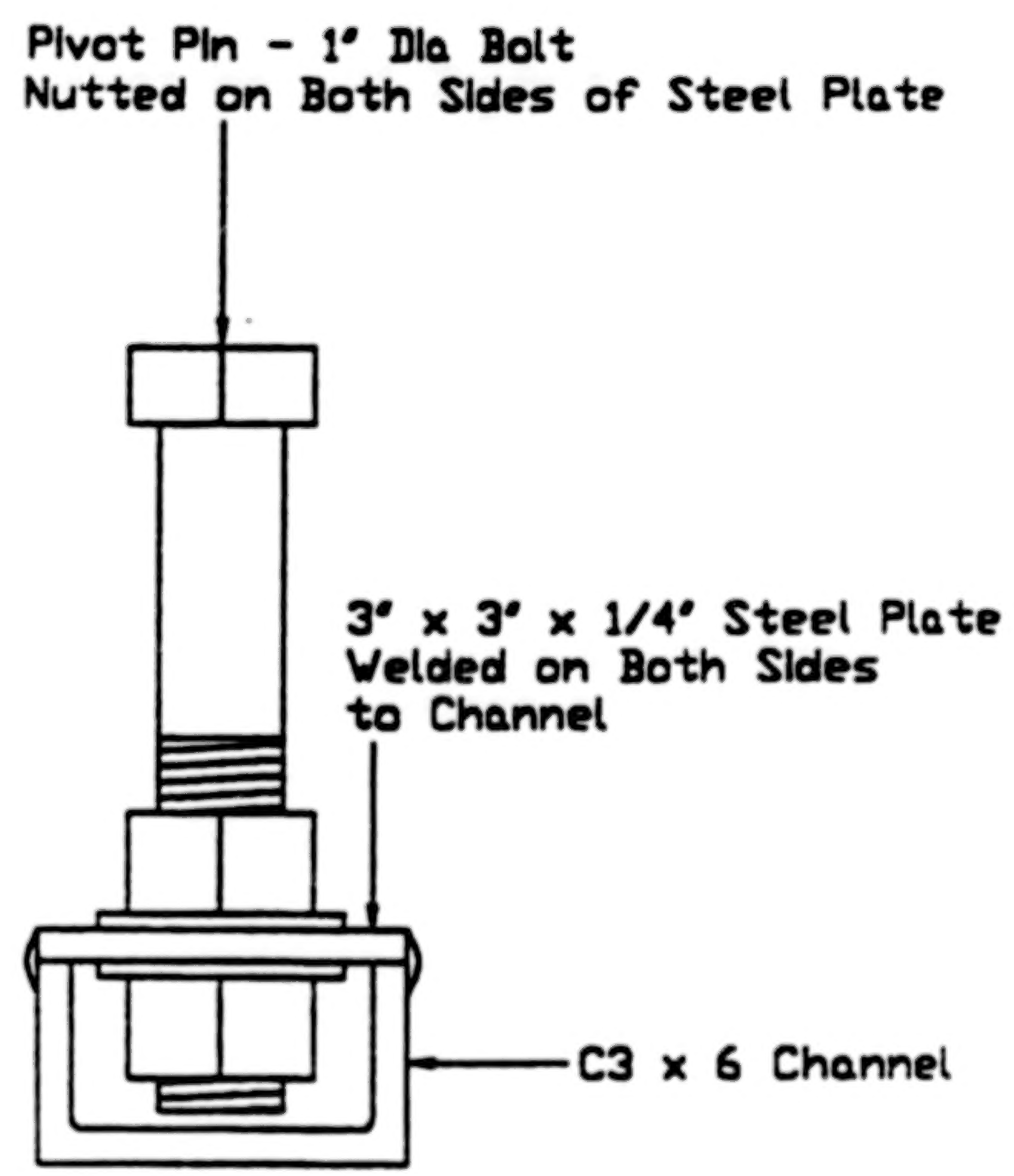

Rotation
Crank Arm - C3 x 6 Channel 18" Long
Bolted to Crank Hub with 2 - 1/2" Bolts
Crank Hub - 8" Dia x 1/4" Steel
18" From CL Drive Shaft
To CL Pivot Pin
1" ID Sperical Take-Up Bearings
Drive Arm Pivot
1" Dia Threaded Ends
3" Take Up Length on Both Sides
Drive Arm
1-1/2" Dia Schedule 80 Black Steel Pipe

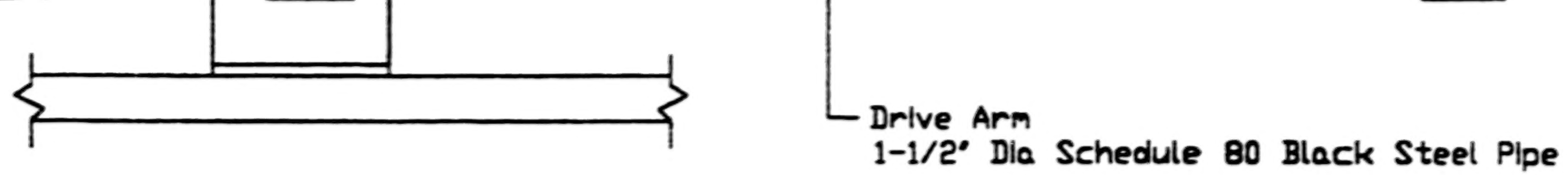
FRONT VIEW
SCALE 1" = 6"



CRANK ARM
SCALE 1" = 6"



END VIEW
SCALE 1" = 3"



CRANK ARM
SCALE 1" = 6'

END VIEW
SCALE: 1" = 3'

FRONT VIEW
SCALE 1" = 6'

NOTES

1. All bearings shall be installed with grease zerks
2. The drive assembly shall be mounted such that the drive arm will operate parallel to track assembly.
3. The length of the drive arm will be determined by position of drive assembly.
   The average length will be made such that the end wipers will reach 1" from the end of the screens.
4. The entire drive system shall be made to operate smoothly with no contact of none bearing surfaces.

DRIVE ASSEMBLY

MACGOWAN DITCH

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